United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Texas Agricultural Experiment Station

Soil Survey of Jack County, Texas

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

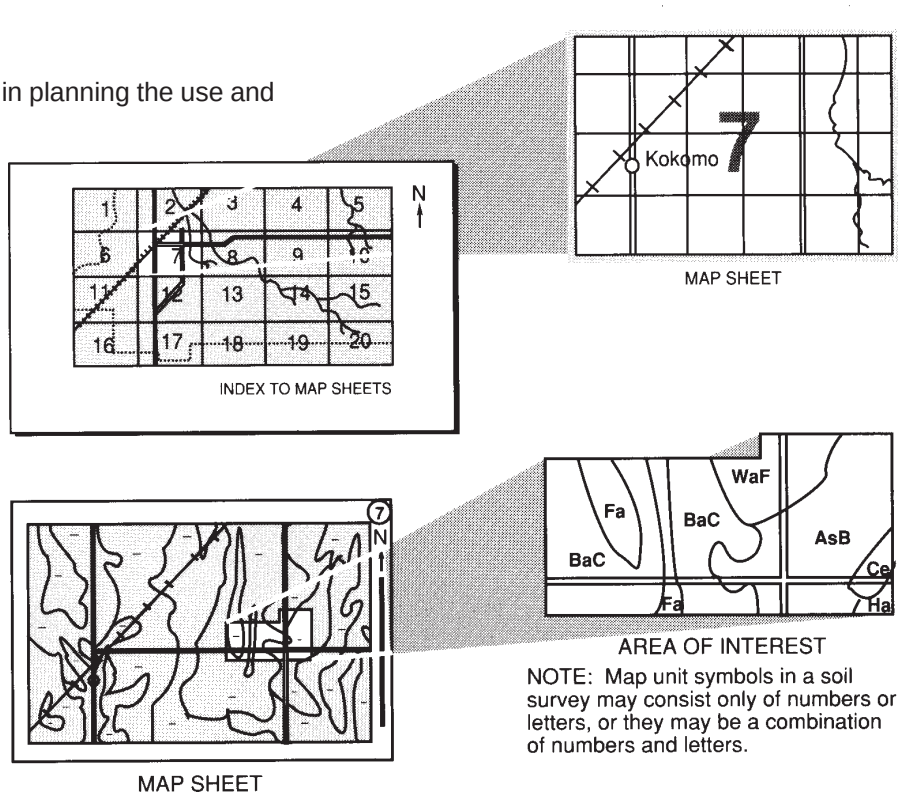
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service and the Texas Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Jack County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: The restored Fort Richardson Hospital, which is south of Jacksboro in Fort Richardson State Park.

Contents

Issued 2005

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Jack County, Texas

By Wilfred E. Crenwelge, Natural Resources Conservation Service

Fieldwork by Wilfred E. Crenwelge, James P. Walters, Joe L. Randell, Charlie G. Meyer, and G.A. "Rusty" Dowell III, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
Texas Agricultural Experiment Station

JACK COUNTY is in the north-central part of Texas (fig. 1). It is bordered on the north by Clay County, on the west by Archer and Young Counties, on the south by Parker and Palo Pinto Counties, and on the east by Wise County. Jacksboro is the county seat and located in the center of the county. In 1995, the county population was about 7,274. Jacksboro had an estimated population of about 3,423. Other incorporated towns in the county are Antelope, Bryson, Jermyn, Joplin, Perrin, and Wizard Wells.

Jack County is slightly rectangular in shape. It has an area of about 921 square miles, or 589,132 acres. The land surface is nearly level to undulating and hilly with low escarpments. The elevation ranges from 800 to 1,520 feet above sea level. The northern part of the county drains into the West Fork of the Trinity River. The southern part drains into the Brazos River. About 48 soils are identified in Jack County. These soils range considerably in texture, depth, reaction, natural drainage, parent material, and other characteristics.

The county has two major land resource areas (MLRAs)—the North Central Prairie MLRA and the Cross Timbers MLRA. The North Central Prairie MLRA comprises 90 percent of the county, and the Cross Timbers MLRA comprises 10 percent.

Erosion is induced by both geological and human forces and is a major factor affecting the soils of Jack County. It has altered and masked many soil characteristics associated with soil formation. Accelerated erosion took place during the 1920's and 1930's—a time of drought and intense grazing by livestock. Cattle, sheep, and goats overgrazed the land and caused the unprotected soil to erode. The effects are still evident in many places. The use of better livestock management and grazing practices by farmers and ranchers is slowly improving the land. Erosion is declining, and vegetation is beginning to cover many eroded areas. In the southeastern part of Jack County, farms and ranches are divided into smaller tracts and sold as homesites.

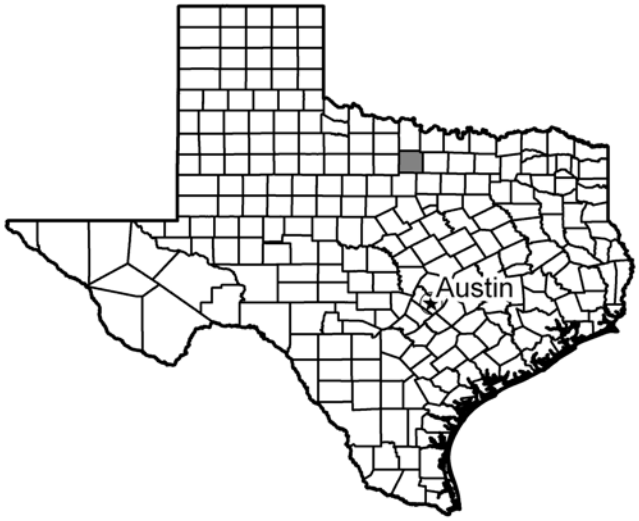

Figure 1.—Location of Jack County in Texas.

Areas of many soils in the county have limitations other than erosion problems that require additional expense and special design if they are used for urban development. Limitations include shrinking and

swelling as moisture conditions change, a shallow depth to bedrock, corrosion of uncoated steel, slope, very slow permeability, and a hazard of flooding.

General Nature of the County

This section provides information about Jack County. It describes settlement and population, agriculture, transportation and market facilities, and climate.

Settlement and Population

Jack County was created on August 14, 1856. It was originally part of Cooke County. It was named for two brothers, William H. Jack and Patrick C. Jack. The Jacks were lawyers who came to Texas from Georgia in 1832. They aided in the fight for Texas independence and held elected offices in the State *(5)*.

The first county courthouse was completed on August 17, 1858. Jacksboro was originally called Mesquiteville because of the large mesquite trees. Although the name was changed to Jacksboro in 1858, the festival "Weekend in Old Mesquiteville" is still celebrated on the second weekend in June.

Around 1867, other frontier posts were established to protect settlers in the western counties of Texas. Fort Richardson was established in 1867. In the spring of 1878, the fort was abandoned as a military post. The original hospital and field officer quarters have been restored and are now preserved as a State park.

The Butterfield Overland Mail Route and the Chicago, Rock Island, and Texas Railway passed through Jacksboro. The Butterfield Stage made its first run from Saint Louis to San Francisco on September 15, 1858. The original Butterfield Overland Mail Route passed about 3 miles south of Jacksboro until a narrow passageway through a cliff was purposely blocked by large boulders, causing the mail route to be diverted through Jacksboro.

In 1908, Tom M. Marks, the first county agent, founded the first Boy's Corn Club, the forerunner of the 4-H Clubs of today. In 1988, Marks's home was purchased by the Jack County Historical Society and became the Jack County Museum.

Agriculture

In Jack County, cattle, horses, small grain, forage sorghum, and pecans are the major agricultural enterprises. They add several million dollars to the economy of the county. Most small grain is used for grazing cattle during the winter and spring. Farms and ranches are divided into smaller tracts for homesites in the southeastern part of the county, an area highly influenced by the Fort Worth-Dallas metroplex.

Because of salt, sulfur, and other mineral contamination, good-quality water is scarce. Some shallow and deep wells provide water for residential, livestock, and small industry uses. Ponds and lakes, however, provide most of the water for livestock and human consumption. Jacksboro Lake is the water supply for Jacksboro and also provides recreation and flood control. The county has 37 flood-prevention dams.

In 1998, about 525,729 acres, or 89.2 percent of the survey area, was open and brushy rangeland, 24,350 acres, or 4.1 percent, was cropland, and 25,550 acres, or 4.3 percent, was pasture. The remaining 2.4 percent was urban and built-up areas, wildlife land, and water areas.

Transportation and Market Facilities

Oil and gas exploration, transportation, servicing, and drilling are the major nonagricultural industries in Jack County. Other industries include tank manufacturing, gas production, and mining rocks and gravel for roadbed material. These industries bring about 25 million dollars to the county's economy.

Climate

Jack County is hot in summer and cool in winter. In winter an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfalls are infrequent. Annual total precipitation is normally adequate for hay and small grains.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Jacksboro, Texas, in the period 1951 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 47 degrees F and the average daily minimum temperature is 34 degrees. The lowest temperature on record, which occurred on January 23, 1966, is 0 degrees. In summer, the average temperature is 83 degrees and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred on June 28, 1980, is 113 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly

accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 29 inches. Of this, 18 inches, or about 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 13 inches. The heaviest 1-day rainfall during the period of record was 9.60 inches, recorded on April 26, 1957. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

The average seasonal snowfall is about 2 inches. The greatest snow depth at any one time during the period of record was 5 inches. On the average, 1 day of the year has at least 1 inch of snow on the ground.

The average relative humidity in mid-afternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

This survey area was mapped at two levels of detail. At the more detailed level, map units are narrowly defined. Map unit boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Boundaries were plotted and verified at wider intervals. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Exray-Truce-Bonti

Very gently sloping to strongly sloping, slowly permeable to moderately permeable, well drained, loamy and stony soils that are underlain by sandstone and shale

The soils of this map unit are on broad, rolling ridges. Drainage is poorly defined on ridges and well defined below the side slopes. Slopes range from 1 to 8 percent. These soils are underlain by sandstone, clay, and shale (fig. 2).

This map unit makes up about 42 percent of Jack County. It is about 27 percent Exray and similar soils, 22 percent Truce soils, 16 percent Bonti soils, and 35 percent soils of minor extent.

The Exray soils are on high hilltops and adjacent to steep side slopes. Typically, the surface layer is brown stony fine sandy loam. The upper part of the subsoil is reddish brown clay loam, and the lower part is red clay. The underlying material, below a depth of 17 inches, is strongly cemented sandstone.

The Truce soils are on broad divides and side slopes. Typically, the surface layer is light brown fine sandy loam. The upper part of the subsoil is reddish brown clay, the middle part is brown clay, and the lower part is yellowish brown clay. The underlying material, below a depth of 43 inches, is light olive brown soft shale.

The Bonti soils are on hilltops. Typically, the surface layer is brown fine sandy loam. The upper part of the subsoil is red clay, and the lower part is reddish brown clay. The underlying material, below a depth of 34 inches, is strongly cemented sandstone.

Of minor extent in this map unit are Bastsil, Chaney, Cona, Darnell, Gowen, Hassee, Owens, Pulexas, Shatruce, Stephenville, and Thurber soils. Bastsil and Chaney soils are in lower positions on stream terraces. Darnell, Cona, and Stephenville soils are in positions similar to the major soils on hilltops. Gowen and Pulexas soils are on flood plains of major streams. Hassee and Thurber soils are in nearly level drainageways. Owens and Shatruce soils are on steep side slopes.

The soils of this map unit are used mainly as rangeland and wildlife habitat because they are predominantly stony. The climax plant community was once an oak savannah where the understory was mid to tall grasses. Today, a dense canopy of woody vegetation and less desirable grasses are dominant in many areas. Proper stocking and controlled grazing are needed in order to increase production and improve forage for livestock and wildlife. Brush management is needed in some areas.

In many areas, the soils are too droughty for use as pasture and cropland. Droughtiness and the hazard of water erosion are the major management concerns. Because of winter moisture, the most suitable crops are small grains. The hazard of soil erosion can be reduced by terracing and planting a cover crop.

These soils provide habitat and a wide variety of food for numerous kinds of wildlife. Good cover is available for resting. The winter food supply can be increased by planting small grains and cool-season legumes.

A few small areas, mostly on the Bonti and Truce soils, are cultivated. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains are used by livestock for winter grazing. The major limitations are stoniness and droughtiness.

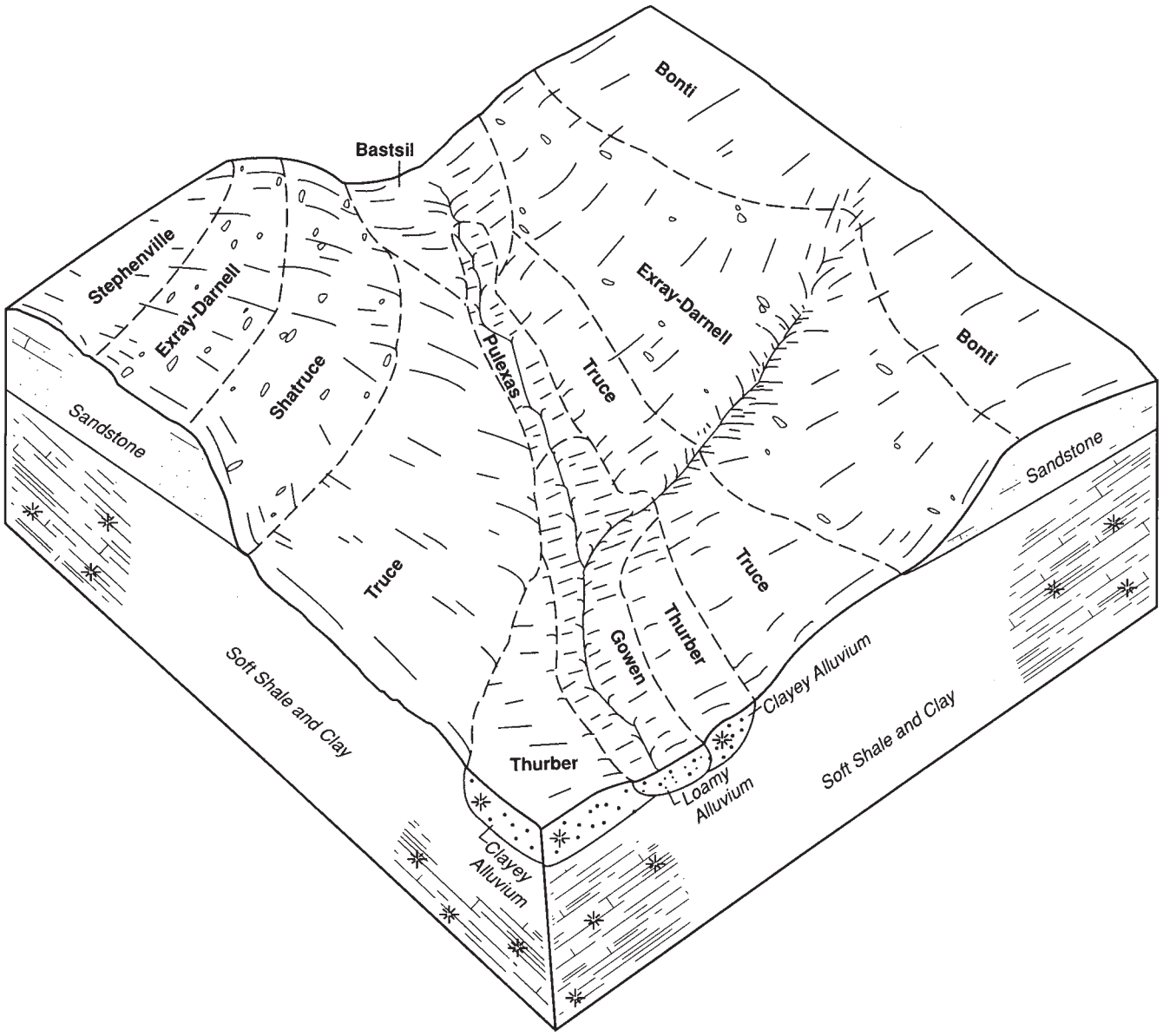

Figure 2.—Typical pattern of soils and underlying material in the Exray-Truce-Bonti general soil map unit.

The major limitations affecting urban and recreational uses are stoniness and slow permeability. Depth to bedrock is also a limitation affecting urban uses.

2. Shatruce

Strongly sloping to very steep, slowly permeable, well drained, loamy soils that are underlain by shale

In this map unit, the landscape typically consists of steep, rocky side slopes. Slopes range from 8 to 50 percent. Drainage is poorly defined. These soils are underlain by shale (fig. 3); however, many sandstone boulders are buried.

This map unit makes up about 18 percent of Jack County. It is about 63 percent Shatruce soils and 37 percent soils of minor extent.

Typically, the Shatruce soils have many boulders and stones on the surface. The surface layer of these soils is dark grayish brown gravelly fine sandy loam. The subsurface layer is light yellowish brown gravelly fine sandy loam. The subsoil is yellowish red clay in the upper part and light reddish brown clay in the lower part. The underlying material, below a depth of 35 inches, is light yellowish brown shale.

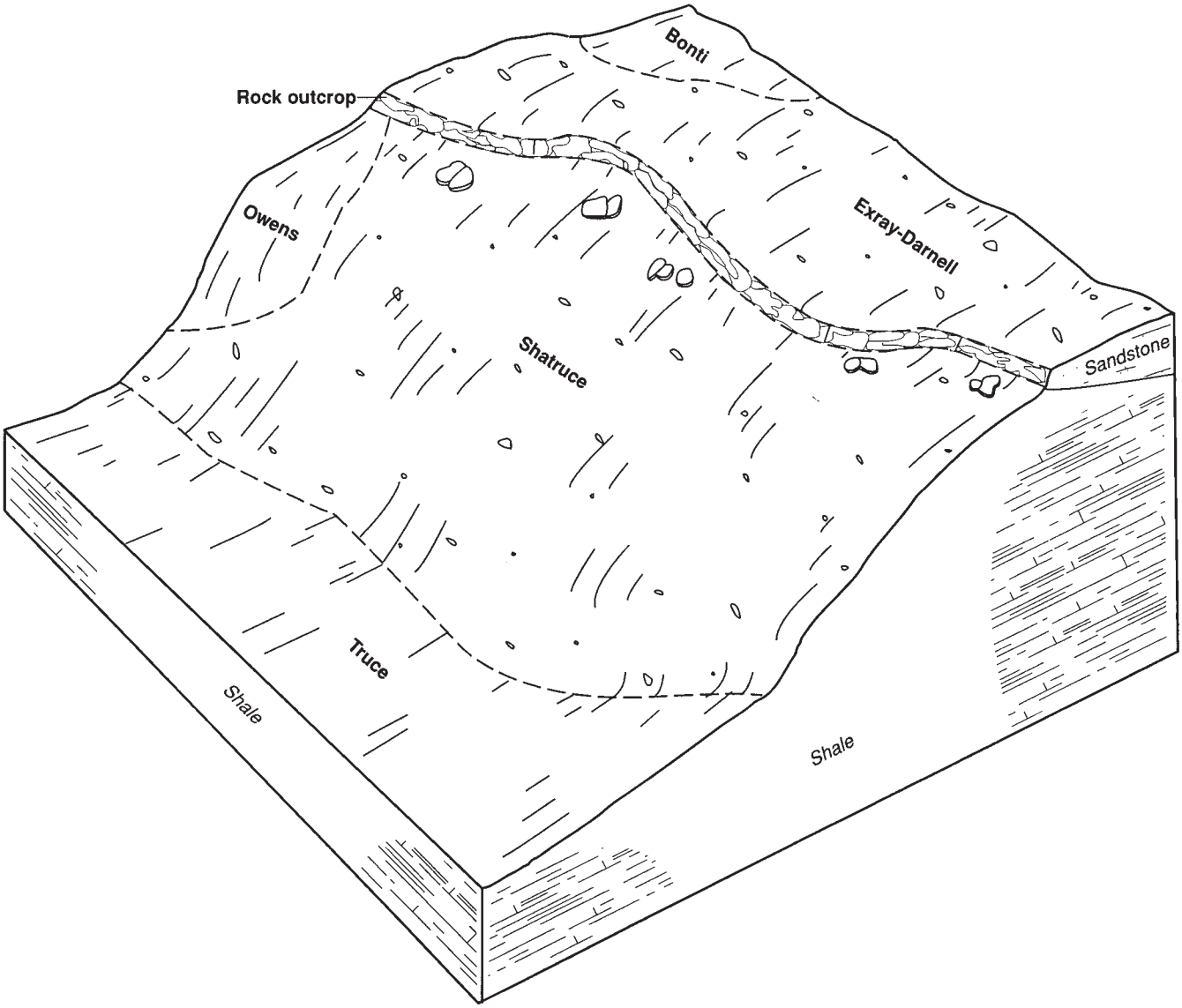

Figure 3.—Typical pattern of soils and underlying material in the Shatruce general soil map unit.

Of minor extent in this map unit are Bastsil, Bonti, Chaney, Darnell, Exray, Gowen, Jacksboro, Owens, Pulexas, and Truce soils. Bastsil and Chaney soils are on toeslopes. Gowen and Pulexas soils are in drainageways. Jacksboro, Bonti, Darnell, and Exray soils are on the highest part of the landscape on ridgetops. Owens soils are on steep, stony side slopes. Truce soils are on footslopes.

The soils of this map unit are used mainly as rangeland and wildlife habitat. Large boulders and steep slopes are the major limitations. Erosion occurs even with minor mismanagement. The climax plant community was once little bluestem and scattered oak trees. Today, it is predominantly oak trees and other woody plants. Proper stocking and controlled grazing are needed in order to increase production, encourage the growth of more desirable plants, and thus improve forage for livestock and wildlife. Brush management is needed in some areas.

The soils of this map unit are not recommended for use as pasture or cropland. The large boulders and steep slopes are limitations.

The soils of this map unit are not recommended for urban or recreational uses because of large boulders and steep slopes. Other limitations affecting urban uses are the potential for shrinking and swelling, which affects foundations, the very slow permeability, which causes severe problems for septic tank absorption

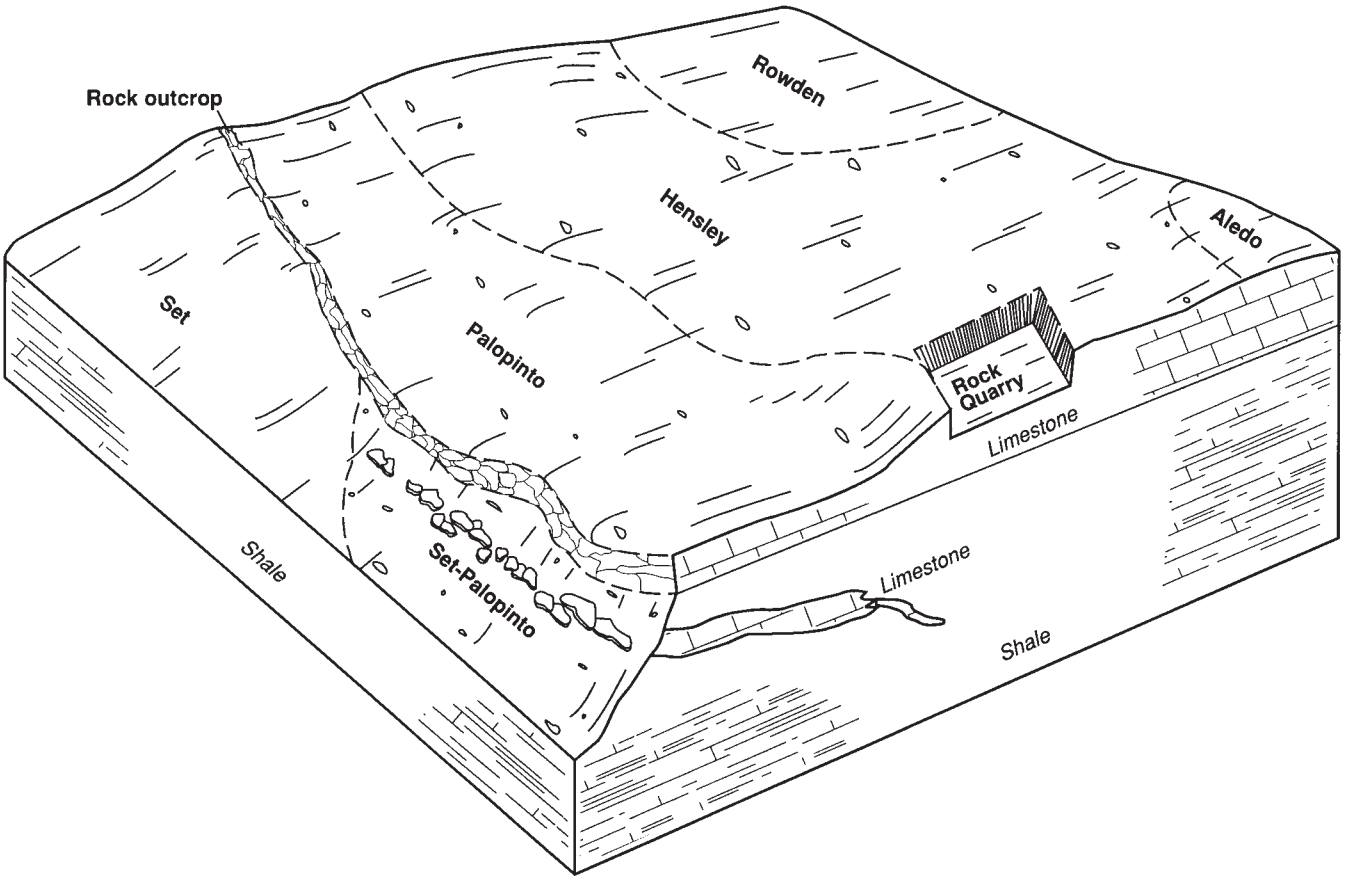

Figure 4.—Typical pattern of soils and underlying material in the Hensley-Palopinto general soil map unit.

fields, and the low soil strength, which causes problems in road construction.

3. Hensley-Palopinto

Gently sloping, slowly permeable to moderately permeable, well drained, loamy and stony soils that are underlain by limestone; on uplands

In this map unit, the landscape typically consists of broad, smooth divides. Slopes range from 1 to 4 percent. Drainage is poorly defined. The soils are underlain by indurated limestone (fig. 4).

This map unit makes up about 13 percent of Jack County. It is about 36 percent Hensley and similar soils, 30 percent Palopinto and similar soils, and 34 percent soils of minor extent.

The Hensley soils are on broad ridges. Typically, many flat stones and flat boulders are on the surface. The surface layer is reddish brown extremely stony loam. The subsoil is reddish brown clay. The underlying material, below a depth of 16 inches, is strongly indurated limestone bedrock.

The Palopinto soils are on broad ridges. Typically, many flat stones and flat boulders are on the surface. The surface layer is reddish brown extremely stony loam. The underlying material, below a depth of 10 inches, is indurated limestone.

Of minor extent in this map unit are Aledo, Bosque, Rowden, and Set soils. Aledo and Rowden soils are on broad ridges. Bosque soils are in drainageways. Set soils are on side slopes.

The soils of this map unit are used mainly as rangeland and wildlife habitat because they are predominantly stony and shallow or very shallow. The native vegetation was once a mixture of mid and tall grasses. The vegetated areas, however, have deteriorated because of heavy continuous grazing. Tall grasses grow in only a few places. They have been replaced by a mixture of short to mid grasses, poor-quality forbs, trees, and brush. Proper stocking and controlled grazing can help these areas to recover and once again be usable for livestock and wildlife.

Wildlife use areas of this map unit mainly for feeding. A good variety of plants is available. Little cover is available for rest or cover. Winter food supply

can be increased by planting small grains and cool-season legumes.

Generally, the soils in this map unit are too stony and too shallow for use as pasture and cropland. Areas of the Hensley soils that are not stony can be used for pasture and cropland; however, little acreage is devoted to these uses. The available water capacity of these soils is very low, and they cannot store sufficient moisture for crops, especially those grown during the dry summer months.

These soils are not recommended for urban or recreational uses. Stoniness and the depth to hard limestone are the major limitations.

4. Anocon-Thurber

Nearly level and very gently sloping, very slowly permeable to moderately slowly permeable, well drained and moderately well drained, loamy soils that are underlain by sandstone and clayey or loamy sediments; on uplands

In this map unit, the landscape typically consists of broad plateaus. Slopes range from 0 to 3 percent. Drainage is well defined. These soils are underlain by clay or stratified clay, soft shale, and sandstone.

This map unit makes up about 10 percent of Jack County. It is about 37 percent Anocon and similar soils, 21 percent Thurber soils, and 42 percent soils of minor extent.

The Anocon soils are on broad hilltops and plateaus. These soils are well drained. Typically, the surface layer is dark brown loam. The upper part of the subsoil is reddish brown clay loam. The middle part is reddish brown clay. The lower part is reddish yellow sandy clay loam. The underlying material, below a depth of 68 inches, is interbedded soft shale, weakly cemented sandstone, and clay.

The Thurber soils are on broad footslopes. These soils are moderately well drained. Typically, the surface layer is dark grayish brown clay loam. The upper part of the subsoil is dark grayish brown clay. The middle part is grayish brown clay. The lower part is light yellowish brown clay loam.

Of minor extent in this map unit are Bastsil, Rowden, Set, Truce, and Winters soils. Bastsil soils are on stream terraces. Rowden soils are on level upland plains. Set and Truce soils are on side slopes. Winters soils are on ridges and side slopes.

The soils of this map unit are used mainly as cropland, rangeland, and wildlife habitat.

About half of the soils in this map unit are used for rangeland because of landowner preference. The native vegetation was once a mid- and short-grass prairie. Today, because of past grazing practices, most of the plants are short grasses. Wildlife feed in these areas because these areas provide a variety of food. Cover and rest areas are scarce for the larger wildlife but good for the smaller wildlife. Winter food supply can be increased by planting small grains and cool-season legumes.

The other half of the soils are used for cropland. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains are used by livestock for winter grazing. Winter and fall crops grow better because of the rainfall. Summer crops usually suffer during July and August because of the lack of rainfall. Few areas are used as pasture. The major concerns are the hazard of water erosion, soil tilth, and maintenance of soil fertility.

These soils are suitable for urban and recreational uses. The major limitation affecting urban uses is the potential for shrinking and swelling. Wetness is a slight limitation affecting urban and recreational uses.

5. Duffau-Windthorst-Keeter

Gently sloping, slowly permeable and moderately slowly permeable, well drained and moderately well drained, loamy and sandy soils that are underlain by mostly sandy and loamy materials; on uplands

In this map unit, the landscape is rolling. Slopes range from 1 to 5 percent. Drainage is distinct and well defined. Some of the sandy material underlying these soils is weakly consolidated, and some is strongly cemented (fig. 5).

This map unit makes up about 6 percent of Jack County. It is about 27 percent Duffau soils, 26 percent Windthorst soils, 12 percent Keeter soils, and 35 percent soils of minor extent.

The Duffau soils are on side slopes along drainageways. Typically, the surface layer is brown very fine sandy loam. The subsurface layer is yellowish brown very fine sandy loam. The upper part of the subsoil is yellowish red sandy clay loam. The middle part is strong brown sandy clay loam. The lower part is reddish yellow sandy clay loam. The underlying material, below a depth of 72 inches, is white sandy clay loam.

The Windthorst soils are on ridgetops and side slopes. Typically, the surface layer is yellowish brown fine sandy loam. The upper part of the subsoil is red clay. The middle part is strong brown sandy clay over mottled yellowish red and pink sandy clay. The lower part of the subsoil is red sandy clay loam. The

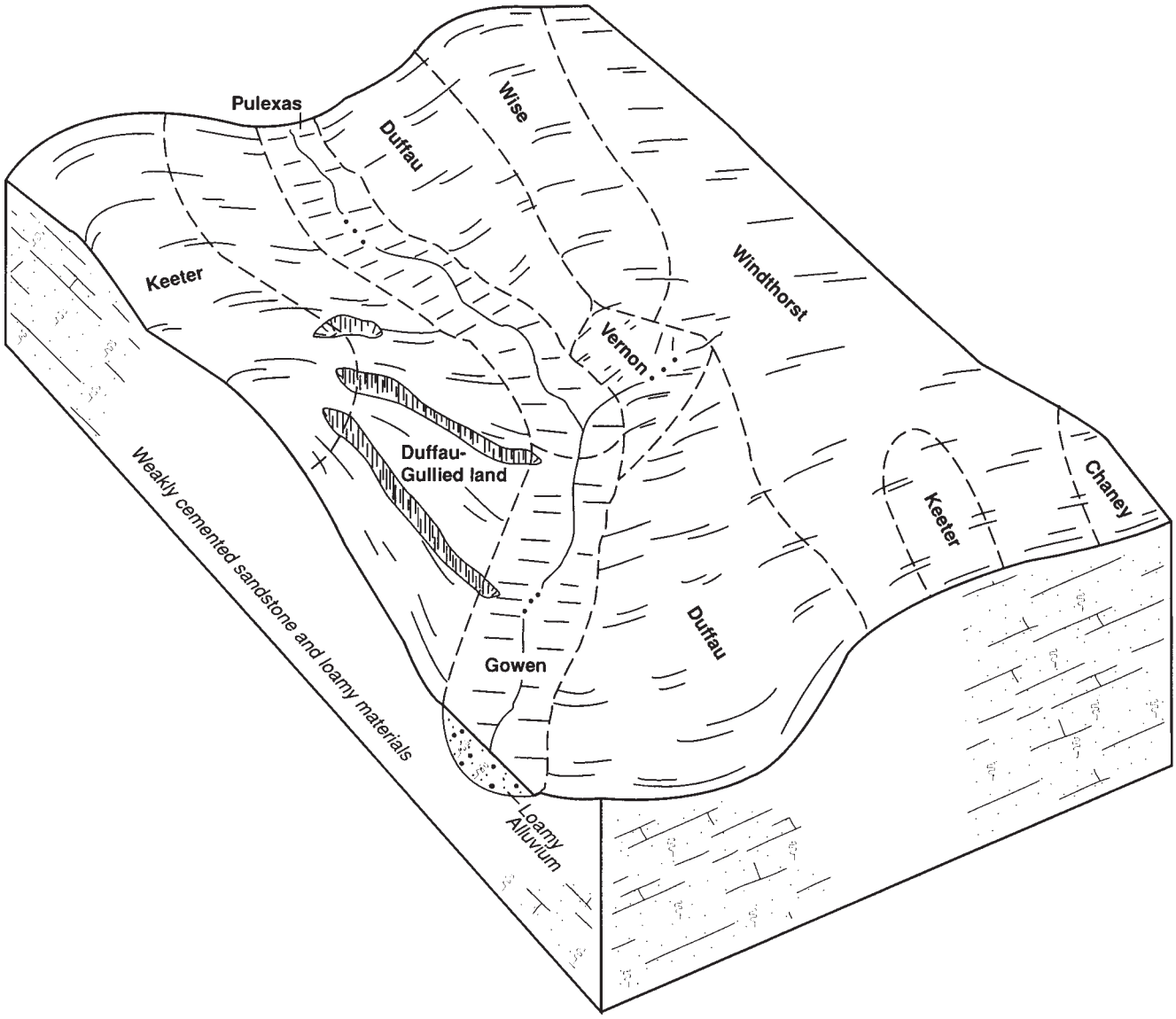

Figure 5.—Typical pattern of soils and underlying material in the Duffau-Windthorst-Keeter general soil map unit.

underlying material, below a depth of 58 inches, is pale yellow sandy clay loam that grades to weakly cemented sandstone.

The Keeter soils are on high ridgetops. Typically, the surface layer is brown very fine sandy loam. The upper part of the subsoil is red clay loam. The middle part is reddish yellow sandy clay loam. The lower part is reddish yellow very fine sandy loam. The underlying material is very pale brown very fine sandy loam. White unconsolidated sand is below a depth of 40 inches.

Of minor extent in this map unit are Chaney, Gowen, Pulexas, Selden, Vernon, and Wise soils. Chaney soils are on ridges and side slopes. Gowen and Pulexas soils are in drainageways. Wise soils are on high ridgetops. Selden soils are on the uppermost part of drainageways. Vernon soils are on footslopes.

The soils of this map unit are used mainly as rangeland and wildlife habitat. The native vegetation was once an oak savannah where the understory was mid to tall grasses. Today, areas have a dense canopy of oak trees. Proper stocking and controlled grazing are needed in order to increase production and improve forage for livestock and wildlife. Brush management is needed in some areas.

Some areas are used for pasture and cropland. The improved grasses that are best adapted to these soils are bermudagrass, bluestems, johnsongrass, and switchgrass. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains

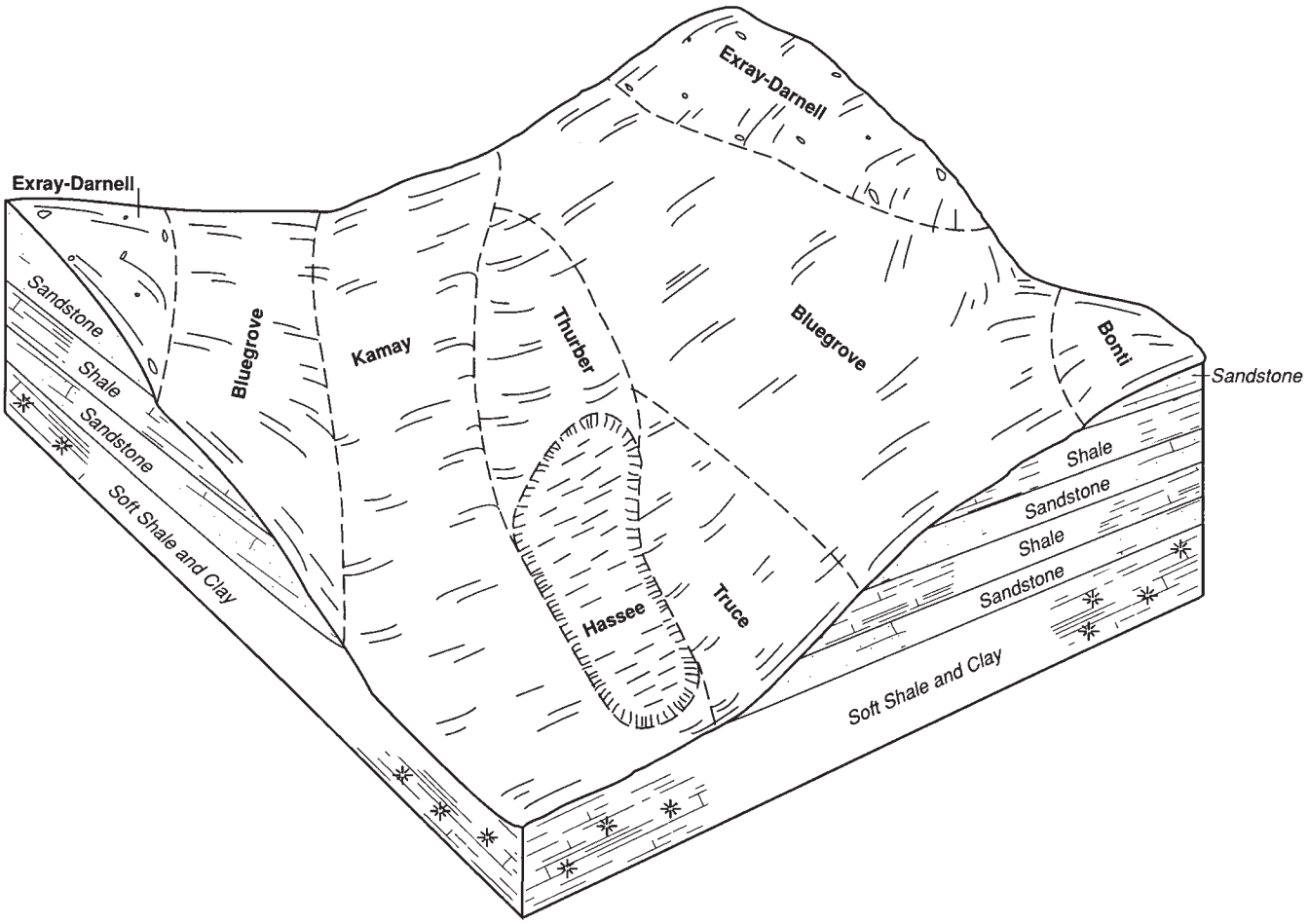

Figure 6.—Typical pattern of soils and underlying material in the Bluegrove-Kamay general soil map unit.

are used by livestock for winter grazing. These soils are suited to the production of peanuts and orchard crops; however, problems occur during the dry summer months. The major concerns are droughtiness, the hazards of wind and water erosion, and maintenance of soil fertility.

The major limitations affecting urban and recreational uses are low soil strength, which affects roads, and the moderate potential for shrinking and swelling. The permeability causes problems for septic tank absorption fields in some areas.

6. Bluegrove-Kamay

Gently sloping, slowly permeable and moderately slowly permeable, well drained, loamy soils that are underlain by sandstone and shale; on uplands

In this map unit, the landscape consists of broad, smooth, rolling ridges. Slopes range from 1 to 3 percent. Drainage is well defined. These soils are underlain by sandstone, clay, or soft shale (fig. 6).

This map unit makes up about 5 percent of Jack County. It is about 44 percent Bluegrove soils, 23 percent Kamay and similar soils, and 33 percent soils of minor extent.

The Bluegrove soils are on hilltops and ridges. Typically, the surface layer is reddish brown loam. The upper part of the subsoil is reddish brown clay loam. The lower part is dark reddish brown clay. The underlying material, below a depth of 28 inches, is weakly cemented sandstone that is interbedded with shale and clay.

The Kamay soils are on side slopes of hills and on ridges. Typically, the surface layer is yellowish brown loam. The subsoil is reddish brown clay. The underlying material, below a depth of 68 inches, is reddish brown soft shale.

Of minor extent in this map unit are Bonti, Darnell, Exray, Gowen, Hassee, Treadway, and Truce soils.

Bonti, Darnell, and Exray soils are on hilltops and ridges. Gowen soils are in drainageways. Hassee soils are in depressions. Treadway and Truce soils are on side slopes and footslopes.

The soils of this map unit are used mainly as rangeland and wildlife habitat. The native plant community was once an oak savannah where the understory was mid grasses. Proper stocking and controlled grazing are needed in order to increase production and improve forage for livestock and wildlife. Brush management is needed in some areas.

Areas of these soils are inhabited by numerous kinds of wildlife. These soils provide a wide variety of food and good cover. Winter food supply can be increased by planting small grains and cool-season legumes.

The Kamay soils are the main cultivated soils. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains are used by livestock for winter grazing. The major concern is the hazard of water erosion because of the lack of plant cover.

The major limitations affecting urban uses are the potential for shrinking and swelling and the depth to bedrock, which affects septic tank absorption fields. These limitations are slight for recreational uses.

7. Gowen-Westfork

Nearly level, moderately permeable, well drained, loamy and clayey soils that are underlain by loamy and clayey alluvium; on flood plains

In this map unit, the landscape consists of flood plains of rivers and creeks. Slopes are 0 to 1 percent.

This map unit makes up about 5 percent of Jack County. It is about 49 percent Gowen soils, 36 percent Westfork soils, and 15 percent soils of minor extent.

The Gowen soils are on the flood plains of narrow drainageways where water flows swiftly. Typically, the upper part of the surface layer is dark grayish brown loam. The lower part is brown loam. The underlying material, below a depth of 41 inches, is dark brown sandy clay loam.

The Westfork soils are on the flood plains of broad drainageways where water flows slowly. Typically, the upper part of the surface layer is reddish brown silty clay. The lower part is brown silty clay. The underlying material, below a depth of 40 inches, is reddish brown silty clay.

Of minor extent in this map unit are Bastsil and Pulexas soils. Bastsil soils are on stream terraces. Pulexas soils are along the outer flood plains and upper stream channels.

The soils of this map unit are used mainly as rangeland and wildlife habitat. The climax plant community was once trees with an understory of mid to tall grasses. Because of grazing pressure, the current plant community is dominated by trees and short grasses. Areas of this map unit can recover with proper management and some brush control. The main limitation is the hazard of frequent flooding.

These soils provide food, cover, and travel lanes for wildlife. The frequent flooding can destroy nests if they are on the ground or on low tree branches. Winter food supply can be increased by planting small grains and cool-season legumes.

These soils are not recommended for use as pasture or cropland, mainly because of the hazard of frequent flooding. Small areas that are occasionally flooded are cultivated. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains are used by livestock for winter grazing. A major concern is the hazard of water erosion. Maintaining a cover crop helps to control soil erosion.

These soils are not recommended for urban or recreational uses mainly because of the frequent flooding.

8. Leeray

Nearly level and very gently sloping, well drained, clayey soils that are underlain by clayey materials; on uplands

In this map unit, the landscape consists of a low-lying flat plain. Slopes range from 0 to 3 percent. Drainageways are poorly defined.

This map unit makes up about 1 percent of Jack County. It is about 79 percent Leeray soils and 21 percent soils of minor extent.

In the Leeray soils, the upper part of the surface layer typically is dark grayish brown clay. The lower part is dark brown clay. The subsoil is grayish brown clay in the upper part and light olive brown clay in the lower part.

Of minor extent in this map unit are Hassee, Set, and Thurber soils. Hassee soils are in depressions. Set soils are on side slopes and in the more sloping areas. Thurber soils are on level plains.

The soils of this map unit are used mainly for cropland. The major crops are sorghums and small grains. Sorghums are used for hay, and small grains are used by livestock for winter grazing. The major concern is maintaining soil tilth and fertility.

Some areas are used for rangeland. Native vegetation is a mixture of mid and short grasses. Today, because of past grazing practices, the grasses

are mainly short grasses. Proper stocking and controlled grazing are needed to improve the plant community.

Because these soils are cultivated, little cover exists for escape or resting areas for wildlife. Wildlife use areas of this map unit infrequently; however, deer graze small grain fields at night.

The major limitations affecting urban uses are the high potential for shrinking and swelling, very slow permeability, and low soil strength.

Detailed Soil Map Units

The map units delineated on the detailed maps represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading “Use and Management of the Soils.”

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some “included” areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Leeray clay, 0 to 1 percent slopes, is a phase of the Leeray series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Exray-Darnell complex, 1 to 8 percent slopes, very stony, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, limestone, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Contents") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

AdB—Aledo clay loam, 1 to 3 percent slopes

Composition

Aledo soil: About 90 percent
Inclusions: About 10 percent

Setting

Landscape: Uplands
Slope class: Gently sloping
Shape of areas: Irregular to oblong
Size of areas: About 8 to 2,000 acres

Typical Profile

Surface layer:
0 to 6 inches—dark brown clay loam

Subsurface layer:
6 to 15 inches—brown very gravelly clay loam

Underlying material:
15 to 35 inches—indurated limestone that is coarsely fractured

Soil Properties and Qualities

Available water capacity: Very low
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low
Depth class: Shallow
Root zone: Shallow
Soil reaction: Moderately alkaline
Shrink-swell potential: Moderate in the surface layer and low in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight
Other features: Layers of weakly cemented limestone and marl that can be cut with conventional ripping equipment in the upper part; blasting is necessary when excavating below a depth of about 20 inches

Inclusions

- Palopinto soils that contain stones throughout, in areas slightly lower on the landscape than the Aledo soil
- Rowden soils that have limestone at a depth of more than 20 inches, in areas slightly lower on the landscape than the Aledo soil
- Wise soils that are underlain by unconsolidated material, in areas slightly lower on the landscape than the Aledo soil
- Areas that are underlain by marly material instead of limestone

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a prairie of many forbs and tall and mid grasses, dominantly little bluestem. In some areas, Texas grama, hairy grama, silver bluestem, buffalograss, Texas wintergrass, hairy tridens, threeawn, post oak, blackjack oak, mesquite, and pricklypear are dominant because of past grazing practices. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too shallow and has too many stones. If the map unit is used as improved pasture, proper grazing management is needed and native plants need to be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the low available water capacity and stones on the surface.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. Deer feed where escape cover is nearby. The habitat for wildlife is enhanced by managing livestock grazing and seeding grasses, forbs, and legumes. Small patchwork plantings of woody plants provide food and cover and increase the diversity of wildlife.

Interpretive Groups

Land capability subclass: VIs
Range site: Shallow

AnB—Anocon loam, 1 to 3 percent slopes

Composition

Anocon soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Uplands, mainly on broad hilltops and plateaus
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: About 30 to 300 acres

Typical Profile

Surface layer:
0 to 8 inches—dark brown loam

Subsoil:
8 to 14 inches—reddish brown clay loam
14 to 28 inches—reddish brown clay
28 to 45 inches—reddish yellow clay
45 to 68 inches—reddish yellow sandy clay loam

Underlying material:
68 to 80 inches—interbedded shale, weakly cemented sandstone, and clay material in shades of red, yellow, and brown

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and slightly acid to moderately alkaline in the subsoil
Shrink-swell potential: Low in the surface layer, moderate in the subsoil, and low in the underlying material
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Bluegrove soils that are slightly higher on the landscape than the Anocon soil
- Thurber and Truce soils that are lower on the landscape than the Anocon soil
- In some areas, outcrops of sandstone on ridgetops and upper side slopes
- Areas where slopes are as much as 5 percent

Use and Management

Main Uses: Cropland and rangeland

Rangeland

The climax plant community is an open prairie of mid grasses, dominantly sideoats grama, vine mesquite, and little bluestem. In some areas, buffalograss, threeawn, Texas wintergrass, lotebush, mesquite, and pricklypear are dominant because of past grazing practices. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and rabbits. Deer and turkeys use the areas infrequently because of the lack of escape and resting cover. Grasses and forbs produce abundant seed for birds. Planting woody plants provides wildlife food and cover and helps to improve the habitat for other wildlife. Managing livestock grazing helps to protect and improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIe
Range site: Loamy Prairie

BaC—Bastsil fine sandy loam, 1 to 5 percent slopes

Composition

Bastsil soil: 90 to 95 percent
Inclusions: 5 to 10 percent

Setting

Landscape: Terraces above flood plains of some major streams
Slope class: Gently sloping
Shape of areas: Subrounded to elongated
Size of areas: About 8 to 350 acres

Typical Profile

Surface layer:
0 to 6 inches—dark brown fine sandy loam

Subsurface layer:
6 to 10 inches—yellowish brown fine sandy loam

Subsoil:
10 to 15 inches—brown sandy clay loam
15 to 30 inches—yellowish red sandy clay loam
30 to 40 inches—brown sandy clay loam
40 to 54 inches—strong brown fine sandy loam
54 to 66 inches—dark yellowish brown fine sandy loam
66 to 72 inches—yellowish brown and brownish yellow fine sandy loam
72 to 80 inches—yellowish brown and brownish yellow sandy clay loam

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low on slopes of 1 to 3 percent and low on slopes of 3 to 5 percent
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately acid or slightly acid in the surface layer and moderately acid to slightly alkaline in the subsoil
Shrink-swell potential: Low in the surface layer and moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Small areas of Chaney and Duffau soils that are higher on the landscape than the Bastsil soil
- Areas of Bastsil soils on footslopes of hills that face south to southeast

Use and Management

Main Use: Improved pasture

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. In some areas, because of past grazing practices, a dense canopy of oaks is dominant and the amount of low-growing woody vegetation and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, deer, turkeys, and squirrels. Deer, turkeys, and squirrels are more abundant where woody vegetation provides feeding and escape cover. Other small mammals and birds feed, rest, and raise their young in these areas. Forbs, browse, mast, and seed-producing grasses provide adequate food for wildlife. Managing livestock grazing and brush control are needed to improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Sandy Loam

BgB—Bluegrove loam, 1 to 3 percent slopes

Composition

Bluegrove soil: About 75 percent
Inclusions: About 25 percent

Setting

Landscape: Plane to convex areas on uplands
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 25 to 100 acres

Typical Profile

Surface layer:
0 to 5 inches—reddish brown loam

Subsoil:
5 to 19 inches—reddish brown clay loam
19 to 28 inches—dark reddish brown clay

Underlying material:
28 to 48 inches—yellow weakly cemented sandstone that is interbedded with shale and clay

Soil Properties and Qualities

Available water capacity: Low
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Neutral
Shrink-swell potential: Low in the surface layer and moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Anocon soils that are slightly higher on the landscape than the Bluegrove soil
- Truce soils that are underlain by shale that has clayey texture, in areas slightly higher on the landscape than the Bluegrove soil
- Bonti soils that have a sandstone layer that is thicker than that of the Bluegrove soil, in similar landscape positions
- Exray soils that are higher on the landscape than the Bluegrove soil or on the slope break and are less than 20 inches thick over sandstone

Use and Management

Main Use: Mainly rangeland; however, areas can be cultivated

Rangeland

The climax plant community is a post oak savannah. The mid-grass understory is dominantly sideoats grama. Because of past grazing practices, some areas are dominantly Texas wintergrass, buffalograss, threeawn, silver bluestem, and mesquite. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, turkeys, and deer. Where woody vegetation is more prevalent, numbers of deer and turkeys are higher. Forbs and browse provide much of the wildlife food. Planting winter food plots of small grain enhances the wildlife habitat. Managing livestock grazing and seeding grasses, forbs, and legumes for food and cover are also beneficial to wildlife.

Interpretive Groups

Land capability subclass: IIIe
Range site: Tight Sandy Loam

BnB—Bonti fine sandy loam, 1 to 3 percent slopes

Composition

Bonti soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Upland ridges
Slope class: Very gently sloping
Shape of areas: Elongated
Size of areas: About 10 to 300 acres

Typical Profile

Surface layer:
0 to 8 inches—brown fine sandy loam

Subsoil:
8 to 22 inches—red clay
22 to 34 inches—reddish brown clay

Underlying material:
34 to 54 inches—reddish yellow and red strongly cemented and coarsely fractured sandstone

Soil Properties and Qualities

Available water capacity: Low or moderate

Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Moderately acid to neutral in the surface layer and strongly acid or moderately acid in the subsoil
Shrink-swell potential: Low in the surface layer and moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Exray and Jacksboro soils that are slightly higher on the landscape than the Bonti soil and have sandstone at a depth of less than 20 inches
- Stephenville soils that have a sandier surface layer than the Bonti soil, in similar landscape positions
- Truce soils on the lower side slopes

Use and Management

Main Uses: Cropland and rangeland

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas are dominated by a dense canopy of oak trees and the amount of low-growing woody plants and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, deer, turkeys, and squirrels. Deer, turkeys, and squirrels are more abundant where woody vegetation provides feeding and escape cover. Other small mammals and birds feed, rest, and raise their young in these areas. Forbs, browse, mast, and seed-producing grasses provide adequate food for wildlife. Managing livestock grazing and brush control improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Sandy Loam

Bo—Bosque clay loam, occasionally flooded

Composition

Bosque soil: About 75 percent
Inclusions: About 25 percent

Setting

Landscape: Flood plains
Slope class: Nearly level; slopes are less than 1 percent
Shape of areas: Elongated
Size of areas: 20 to about 300 acres

Typical Profile

Surface layer:
0 to 30 inches—dark grayish brown clay loam
30 to 40 inches—brown clay loam

Subsoil:
40 to 47 inches—dark grayish brown clay
47 to 80 inches—light brownish gray clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderately permeable
Drainage class: Well drained
Runoff: Very low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately alkaline
Shrink-swell potential: Low
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Flooding: About once every 2 to 20 years for very brief periods
Parent material: Calcareous alluvial deposits

Inclusions

- Gowen soils that are noncalcareous, in landscape positions similar to those of the Bosque soil

• Pulexas soils on the higher ridges or overwashes along edges of the flood plain or near stream channels

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is tall grasses, dominantly switchgrass, indiangrass, big bluestem, and little bluestem. Trees, vines, and scattered browse also occur. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, kleingrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth. The major limitation is the hazard of flooding. Pecan trees grow well on this soil.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, squirrels, doves, quail, and furbearers. Numerous reptiles and amphibians are also present. Turkeys commonly use the larger trees for roosting. Many choice plants provide food for deer and turkeys. This soil provides areas for resting, nesting, and escape. Managing livestock grazing improves wildlife habitat. Food plots of small grain provide food for deer and turkeys.

Interpretive Groups

Land capability subclass: IIw
Range site: Loamy Bottomland

ChC—Chaney loamy fine sand, 1 to 5 percent slopes

Composition

Chaney soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Uplands
Slope class: Gently sloping
Shape of areas: Irregular to oblong
Size of areas: 8 to 120 acres

Typical Profile

Surface layer:
0 to 9 inches—dark grayish brown loamy fine sand

Subsoil:
9 to 17 inches—reddish brown sandy clay
17 to 26 inches—brownish yellow sandy clay
26 to 37 inches—yellowish brown sandy clay that has light yellowish brown and light gray mottles
37 to 50 inches—white sandy clay loam

Underlying material:
50 to 80 inches—light gray sandy clay loam that has shaly and clayey material

Soil Properties and Qualities

Available water capacity: High
Permeability: Slow
Drainage class: Moderately well drained
Runoff: Medium
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and moderately acid to moderately alkaline in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Slight
Hazard of wind erosion: High; wind erosion has resulted in mounded areas along some fence rows where the soil has been cultivated

Inclusions

• Duffau soils in landscape positions similar to those of the Chaney soil
• Small areas of Keeter and Windthorst soils on the slightly higher ridges
• Selden and Truce soils in slight depressions

Use and Management

Main Uses: Pasture and cropland

Rangeland

The climax plant community is an open savannah with scattered stands of post oak and blackjack oak and tall and mid grasses. Because of past grazing practices, mid and short grasses, such as silver bluestem, tall dropseed, sand dropseed, Texas wintergrass, and threeawn, and dense stands of oak and greenbrier are dominant. Proper stocking and controlled grazing are necessary to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, indiangrass, johnsongrass, switchgrass, and weeping lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production. The intake of moisture is rapid in the surface layer and becomes moderately slow or slow in the subsoil.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Farming on the contour and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, doves, quail, and squirrels. These animals feed extensively on acorns and other mast, crop residue, and winter cover crops. Other small animals and birds feed and raise their young in areas of this map unit. Controlling brush in patterns, managing livestock grazing, and seeding grasses, forbs, and legumes improve wildlife habitat. Planting food plots of small grains in association with woody cover is also beneficial.

Interpretive Groups

Land capability subclass: IIIe
Range site: Loamy Sand

CoD—Cona fine sandy loam, 3 to 8 percent slopes, stony

Composition

Cona soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Hillsides and narrow stream divides
Slope class: Gently sloping or strongly sloping
Shape of areas: Elongated to subrounded
Size of areas: 15 to 300 acres

Typical Profile

Surface layer:
0 to 3 inches—dark grayish brown fine sandy loam

Subsurface layer:
3 to 7 inches—brown gravelly fine sandy loam

Subsoil:
7 to 26 inches—red clay
26 to 38 inches—yellowish red clay

Underlying material:
38 to 60 inches—yellowish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Very slow
Drainage class: Well drained
Runoff: Medium on the 3 to 5 percent slopes and high on the 5 to 8 percent slopes
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Slightly acid to slightly alkaline in the surface and subsurface layers and strongly acid or moderately acid in the subsoil
Shrink-swell potential: High in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate
Rock fragments: Sandstone or sandstone conglomerate fragments 10 to 24 inches across and 3 to 20 inches thick cover about 4 percent of the surface; rock fragments less than 10 inches across cover about 8 percent of the surface; boulders cover less than 1 percent of the surface; rounded siliceous pebbles that are mainly less than 1 inch in diameter are in the surface layer, average about 5 percent of the volume, and are more abundant near the large boulders and less abundant or absent near the smaller conglomerate fragments

Inclusions

- Chaney soils on outcrops of thin strata of sandstone
- Truce soils on the less sloping footslopes
- Windthorst soils on the slightly higher ridges
- In some areas, a narrow band of boulders as much as 6 feet across that outcrops on edges of ridgetops or on mid slopes

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is an open stand of mostly post oak trees. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, woody plants, such as post oak, elm, greenbrier, mesquite, and skunkbush, are dominant in some areas. Little bluestem still occurs; however, many lower successional grasses, such as threeawn and dropseed, are present. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It has too many stones. If this map unit is used as pasture, proper livestock grazing practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of surface stones.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, quail, and doves. Woody plants provide good cover. Continuous overgrazing has caused oak and elm trees to increase in abundance and grasses and forbs to decrease. Controlling brush in patterns and managing livestock grazing improve wildlife habitat. Establishing winter food plots enhances the habitat for deer.

Interpretive Groups

Land capability subclass: VIs
Range site: Sandstone Hill

DAM—Dams

This map unit consists of barriers that are built across a waterway to control the flow or raise the level of water.

This map unit is not assigned a land capability subclass or a range site.

DfC—Duffau very fine sandy loam, 1 to 5 percent slopes

Composition

Duffau soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Side slopes
Slope class: Gently sloping
Shape of areas: Areas are longer than they are wide
Size of areas: 30 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—brown very fine sandy loam

Subsurface layer:
6 to 15 inches—yellowish brown very fine sandy loam

Subsoil:
15 to 40 inches—yellowish red sandy clay loam
40 to 58 inches—strong brown sandy clay loam
58 to 72 inches—reddish yellow sandy clay loam

Underlying material:
72 to 80 inches—white sandy clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low on slopes of 1 to 3 percent and low on slopes of 3 to 5 percent
Depth class: Very deep
Root zone: Very deep
Soil reaction: Neutral or slightly alkaline in the surface and subsurface layers and slightly acid or neutral in the subsoil
Shrink-swell potential: Low
Hazard of water erosion: High
Hazard of wind erosion: Moderate

Inclusions

- Chaney and Selden soils in the slightly concave areas
- Keeter, Windthorst, and Wise soils on the higher ridgetops
- Small areas of windblown sand

Use and Management

Main Use: Rangeland; however, areas can be cultivated

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas are dominated by a dense canopy of oak trees and the amount of low-growing woody plants and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by deer, doves, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas enhances the habitat for deer as well as for other wildlife. Managing livestock grazing and controlling brush in patterns improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Sandy Loam

DgC—Duffau-Gullied land complex, 1 to 5 percent slopes

Composition

Note: Areas of the Duffau soil and Gullied land are so intricately mingled that mapping them separately is not practical at the scale used.
Duffau soil: About 60 percent
Gullied land: About 20 percent
Inclusions: About 20 percent

Setting

Landscape: Eroded side slopes
Slope class: Gently sloping
Shape of areas: Areas are longer than they are wide
Size of areas: 30 to 500 acres

Typical Profile

Duffau

Surface layer:
0 to 7 inches—brown very fine sandy loam

Subsurface layer:
7 to 11 inches—yellowish brown very fine sandy loam

Subsoil:
11 to 28 inches—red sandy clay loam
28 to 36 inches—yellowish red sandy clay loam
36 to 65 inches—coarsely mottled red and reddish yellow sandy clay loam

Underlying material:
65 to 80 inches—coarsely mottled white and yellow weakly cemented sandstone

Gullied land

This part of the map unit has gullies that are 2 to 30 feet deep, 6 to 50 feet wide, and 20 to 300 feet apart. Most of the gullies cannot be crossed with farm machinery.

Properties and Qualities of the Duffau Soil

Available water capacity: High
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low on slopes of 1 to 3 percent and low on slopes of 3 to 5 percent
Depth class: Very deep
Root zone: Very deep
Soil reaction: Neutral or slightly alkaline in the surface layer and slightly acid to slightly alkaline in the subsoil
Shrink-swell potential: Low
Hazard of water erosion: High
Hazard of wind erosion: Moderate

Inclusions

- Chaney and Selden soils in the slightly concave areas
- Keeter, Windthorst, and Wise soils on the higher ridgetops
- Small areas of windblown sand

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas have a dense canopy of oak trees and the amount of low-growing woody plants and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The gullies, which limit the use of this map unit, need shaping before improved grasses are planted or seeded. The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

Gullies are a major limitation affecting the planting of crops. The gullies should be shaped and terraces and waterways should be constructed before this map unit is used for cropland.

Wildlife habitat

Areas of this map unit are inhabited by deer, doves, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas enhances the habitat for deer as well as for other wildlife. Managing livestock grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: Duffau—VIe; Gullied land—VIIe
Range site: Duffau—Sandy Loam; Gullied land—none assigned

EdD—Exray-Darnell complex, 1 to 8 percent slopes, very stony

Composition

Note: The soils in this map unit are so intricately mingled that mapping them separately is not practical at the scale used.
Exray soil: About 40 percent
Darnell soil: About 35 percent
Inclusions: About 25 percent

Setting

Landscape: Convex, sloping to moderately steep side slopes and narrow ridgetops above drainageways; both soils are scattered throughout the mapped areas but the Darnell soil is dominant on the steeper parts and the edges of slope breaks
Shape of areas: Irregular or elongated
Size of areas: 20 to 150 acres

Typical Profile

Exray

Surface layer:
0 to 5 inches—brown fine sandy loam

Subsoil:
5 to 9 inches—reddish brown clay loam
9 to 17 inches—red clay

Underlying material:
17 to 37 inches—yellowish brown strongly cemented coarsely fractured sandstone

Darnell

Surface layer:
0 to 4 inches—dark brown fine sandy loam

Subsoil:
4 to 15 inches—strong brown fine sandy loam

Underlying material:
15 to 35 inches—strongly cemented sandstone

Soil Properties and Qualities

Available water capacity: Exray—low; Darnell—very low
Permeability: Exray—moderately slow; Darnell—moderately rapid
Drainage class: Exray—well drained; Darnell—well drained or somewhat excessively drained
Runoff: Exray—very low on slopes of 1 to 3 percent, low on slopes of 3 to 5 percent, and medium on slopes of 5 to 8 percent; Darnell—negligible on slopes of 1 to 3 percent, very low on slopes of 3 to 5 percent, and low on slopes of 5 to 8 percent
Depth class: Shallow
Root zone: Shallow
Soil reaction: Exray—neutral in the surface layer and slightly acid in the subsoil; Darnell—slightly acid or neutral in the surface layer and moderately acid to neutral in the subsoil
Shrink-swell potential: Exray—moderate in the subsoil; Darnell—low
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate
Rock fragments: Sandstone or sandstone

conglomerate fragments 10 to 24 inches across and 3 to 20 inches thick cover 5 to 15 percent of the surface; rock fragments less than 10 inches across cover 1 to 5 percent of the surface

Inclusions

- Bands of rock outcrop
- Bonti and Stephenville soils that have sandstone at a depth of more than 20 inches, in the slightly lower landscape positions
- Chaney soils that have a sandier surface layer than the Exray and Darnell soils, have sandstone at a depth of more than 20 inches, and are slightly lower on the landscape
- Cona soils that have sandstone at a depth of more than 20 inches, in the higher landscape positions
- Jacksboro soils in the higher landscape positions
- Shatruce soils that are underlain by shale, on steep side slopes

Use and Management

Major Uses: Rangeland and wildlife habitat

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas have a dense canopy of oaks and the amount of low-growing woody plants and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

These soils are not recommended for use as improved pasture. They are too shallow and have too many stones. If this map unit is used for pasture, proper livestock grazing practices are needed and native plants should be introduced if none are present.

Cropland

These soils are not recommended for use as cropland. The major limitations are the low available water capacity and surface stones.

Wildlife habitat

Areas of these soils are inhabited by deer, turkeys, quail, and doves. Woody plants provide good cover. Continuous overgrazing has caused oak and elm trees to increase in abundance and grasses and forbs to decrease. Managing livestock grazing and controlling brush in patterns improve wildlife habitat. Establishing winter food plots enhances the habitat for deer.

Interpretive Groups

Land capability subclass: Exray—VIs; Darnell—VIIs
Range site: Sandstone Hill

Go—Gowen loam, occasionally flooded

Composition

Gowen soil: About 70 percent
Inclusions: About 30 percent

Setting

Landscape: Flood plains of major streams and drainageways
Slope class: Nearly level or slightly undulating; slopes are less than 1 percent
Shape of areas: Elongated
Size of areas: 20 to 1,000 acres

Typical Profile

Surface layer:
0 to 28 inches—dark grayish brown loam
28 to 41 inches—brown loam

Subsoil:
41 to 80 inches—light yellowish brown sandy clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderate
Drainage class: Well drained
Runoff: Negligible
Depth class: Very deep
Root zone: Very deep
Soil reaction: Neutral in the surface layer and moderately alkaline in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Flooding: About once every 2 to 20 years for very brief periods

Inclusions

- Pulexas soils that are generally in drainageways at the higher elevations and on natural levees near stream channels
- Bosque soils that are calcareous throughout, in landscape positions similar to those of the Gowan soil
- Small eroded areas that have a surface layer of clay loam or silty clay loam

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is tall grasses, dominantly switchgrass, indiangrass, big bluestem, and little bluestem. Trees, vines, and scattered browse typically occur. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, kleingrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth. The major limitation is the hazard of flooding. Pecan trees grow well on this soil.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, squirrels, doves, quail, and furbearers. Numerous reptiles and amphibians are also present. Turkeys commonly use the larger trees for roosting. Many choice plants provide food for deer and turkeys. This soil provides areas for resting, nesting, and escape. Managing livestock grazing improves wildlife habitat. Food plots of small grains provide food for deer and turkeys.

Interpretive Groups

Land capability subclass: IIw
Range site: Loamy Bottomland

Gw—Gowen loam, frequently flooded

Composition

Gowen soil: About 70 percent
Inclusions: About 30 percent

Setting

Landscape: Flood plains of major streams and drainageways
Slope class: Nearly level or slightly undulating; slopes are less than 1 percent
Shape of areas: Elongated
Size of areas: 200 to 2,000 acres

Typical Profile

Surface layer:
0 to 27 inches—dark grayish brown loam
27 to 43 inches—very dark gray clay loam

Underlying material:
43 to 80 inches—dark brown sandy clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderate
Drainage class: Well drained
Runoff: Negligible
Depth class: Very deep
Root zone: Very deep
Soil reaction: Neutral in the surface layer and moderately alkaline in the underlying material
Shrink-swell potential: Moderate
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Flooding: Once every 1 or 2 years for very brief periods

Inclusions

- Pulexas soils in drainageways at the higher elevations and on natural levees near stream channels
- Bosque soils that are calcareous throughout, in landscape positions similar to those of the Gowan soil
- Small eroded areas that have a surface layer of clay loam or silty clay loam

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is tall grasses, dominantly switchgrass, indiangrass, big bluestem, and little bluestem. Trees, vines, and scattered browse typically occur. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, kleingrass, blue panicum, and switchgrass. Weed control, brush control,

controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

This soil is not recommended for use as cropland. The main limitation is the hazard of frequent flooding.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, squirrels, doves, quail, and furbearers. Numerous reptiles and amphibians are also present. Turkeys commonly use the larger trees for roosting. Many choice plants provide food for deer and turkeys. This soil provides areas for resting, nesting, and escape. Managing livestock grazing improves wildlife habitat. Food plots of small grains provide food for deer and turkeys.

Interpretive Groups

Land capability subclass: Vw
Range site: Loamy Bottomland

HaA—Hassee loam, 0 to 1 percent slopes

Composition

Hassee soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Depressions, in mostly concave areas
Slope class: Nearly level
Shape of areas: Oval to oblong
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—dark grayish brown loam

Subsurface layer:
8 to 14 inches—light brownish gray loam

Subsoil:
14 to 38 inches—dark grayish brown silty clay
38 to 60 inches—dark grayish brown silty clay
60 to 80 inches—grayish brown clay

Soil Properties and Qualities

Available water capacity: High
Permeability: Very slow
Drainage class: Moderately well drained
Runoff: Low
Water table: Perched above the subsoil at a depth of 6 to 12 inches for brief periods
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface and subsurface layers and neutral to moderately alkaline in the subsoil
Shrink-swell potential: High
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

Inclusions

- Small areas of Anocon, Leeray, Truce, and Thurber soils that are higher on the landscape than the Hassee soil
- A few small areas of a soil closely similar to the Hassee soil that has grayish and brownish mottles in the upper layers, in depressions

Use and Management

Main Use: Rangeland; however, areas can be cultivated

Rangeland

The climax plant community is an open prairie of mid and short grasses that is dominated by sideoats grama. Because of past grazing practices, silver bluestem, buffalograss, mesquite, pricklypear, and lotebush are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and rabbits. A good selection of forbs is available for deer forage; however, little cover is available for escape and resting. Numerous annual and perennial plants provide food and cover for birds. Planting woody vegetation, managing livestock grazing, and seeding grasses,

forbs, and legumes improve wildlife habitat. Small grains provide winter food for deer.

Interpretive Groups

Land capability subclass: IIIw
Range site: Claypan Prairie

HeB—Hensley loam, 1 to 3 percent slopes

Composition

Hensley soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Plane to convex slopes and ridges on uplands
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 15 to about 200 acres

Typical Profile

Surface layer:
0 to 5 inches—reddish brown loam

Subsoil:
5 to 15 inches—reddish brown clay

Underlying material:
15 to 35 inches—fractured indurated limestone

Soil Properties and Qualities

Available water capacity: Very low
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Shallow
Root zone: Shallow
Soil reaction: Slightly acid to slightly alkaline in the surface layer and neutral or slightly alkaline in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Palopinto soils that have more stones in the surface layer than the Hensley soil, in the slightly higher landscape positions
- Rowden soils that have limestone bedrock at a depth of more than 20 inches, in the lower landscape positions
- A few small areas of Hensley soils where stones cover more than 1 percent of the surface

Use and Management

Main Use: Rangeland; however, areas can be cultivated

Rangeland

The climax plant community is a savannah of live oak and post oak. The understory is dominantly little bluestem. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, threeawn, and mesquite are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves and quail. Forbs and grasses provide seeds as a food source for these birds. The rough terrain attracts rattlesnakes. Forbs, mast, and browse provide food for deer, which use other areas for more suitable cover. Managing grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: IVs
Range site: Redland

HnB—Hensley loam, 1 to 3 percent slopes, extremely stony

Composition

Hensley soil: About 80 to 90 percent
Inclusions: About 10 to 20 percent

Setting

Landscape: Plane to convex slopes and ridges on uplands

Slope class: Gently sloping
Shape of areas: Irregular
Size of areas: 15 to about 200 acres

Typical Profile

Surface layer:
0 to 4 inches—reddish brown loam

Subsoil:
4 to 16 inches—reddish brown clay

Underlying material:
16 to 40 inches—very pale brown strongly cemented limestone bedrock

Soil Properties and Qualities

Available water capacity: Very low
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Shallow
Root zone: Shallow
Soil reaction: Slightly acid to slightly alkaline in the surface layer and neutral or slightly alkaline in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Rock fragments: Limestone fragments 10 to 24 inches across and 1 to 10 inches thick cover 15 to 40 percent of the surface; limestone fragments less than 10 inches across cover 5 to 10 percent of the surface

Inclusions

- Palopinto soils in the slightly higher landscape positions
- Rowden soils that have limestone at a depth of more than 20 inches, in the lower landscape positions
- A few small areas of Hensley soils where stones cover less than 1 percent of the surface

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of live oak and post oak. The understory is dominantly little bluestem. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, threeawn, and mesquite are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas (fig. 7).

Pasture

This soil is not recommended for use as improved pasture. It is too shallow and has too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the low available water capacity and surface stones.

Wildlife habitat

Areas of this soil are inhabited by doves and quail. Forbs and grasses provide seeds for these birds. The rough terrain attracts rattlesnakes. Forbs, mast, and browse provide food for deer, which use other areas for more suitable cover. Managing livestock grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: VIs
Range site: Redland

JaB—Jacksboro fine sandy loam, 1 to 3 percent slopes

Composition

Jacksboro soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Upland ridges
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Surface layer:
0 to 4 inches—dark brown fine sandy loam

Subsurface layer:
4 to 11 inches—light brown very gravelly fine sandy loam

Subsoil:
11 to 18 inches—red very gravelly clay

Underlying material:
18 to 25 inches—indurated conglomerate sandstone

Figure 7.—An area of Hensley loam, 1 to 3 percent slopes, extremely stony. Fires control brush and help to improve the production of native grasses on shallow soils, such as this Hensley soil.

Soil Properties and Qualities

Available water capacity: Very low
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low
Depth class: Shallow
Root zone: Shallow
Soil reaction: Slightly acid or neutral in the surface layer and strongly acid to slightly acid in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

Inclusions

- Darnell and Exray soils in landscape positions slightly lower than those of the Jacksboro soil
- Bonti soils that have sandstone at a depth of more than 20 inches, in landscape positions slightly lower than those of the Jacksboro soil
- Rock outcrops along escarpments

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas have a dense canopy of oaks and the amount of low-growing woody plants and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too shallow and has too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the low available water capacity and surface stones.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, quail, and doves. Woody plants provide good cover. Continuous overgrazing has caused an increase in the number of oak and elm trees and a decrease in the amount of grasses and forbs. Managing livestock grazing and controlling brush in patterns improve wildlife habitat. Establishing winter food plots enhances the habitat for deer.

Interpretive Groups

Land capability subclass: VIs
Range site: Sandstone Hill

KaB—Kamay loam, 1 to 3 percent slopes

Composition

Kamay soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Uplands
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 100 to 500 acres

Typical Profile

Surface layer:
0 to 10 inches—yellowish brown loam

Subsoil:
10 to 68 inches—reddish brown clay

Underlying material:
68 to 80 inches—reddish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: High
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and neutral to moderately alkaline in the subsoil
Shrink-swell potential: High in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Anocon soils in landscape positions similar to those of the Kamay soil
- Bluegrove soils that have sandstone at a depth of less than 40 inches, in landscape positions slightly higher than those of the Kamay soil
- Hassee soils in the lower landscape positions

Use and Management

Main Use: Cropland

Rangeland

The climax plant community is an open prairie of mid grasses, dominantly sideoats grama, vine mesquite, and little bluestem. Because of past grazing practices, buffalograss, threeawn, Texas wintergrass, lotebush, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and rabbits. Deer and turkeys use the areas infrequently because of the lack of escape and resting cover. Grasses and forbs produce abundant seed for birds. Planting woody plants provides wildlife food and cover. Managing livestock grazing improves and protects wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Claypan Prairie

KtC—Keeter very fine sandy loam, 1 to 6 percent slopes

Composition

Keeter soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Convex ridges of interstream divides
Slope class: Gently sloping
Shape of areas: Irregular to elongated; areas follow the contour of the ridges
Size of areas: 8 to more than 40 acres

Typical Profile

Surface layer:
0 to 6 inches—brown very fine sandy loam

Subsoil:
6 to 17 inches—red clay loam
17 to 25 inches—reddish yellow sandy clay loam
25 to 31 inches—reddish yellow very fine sandy loam

Underlying material:
31 to 40 inches—very pale brown very fine sandy loam
40 to 80 inches—white unconsolidated sand

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low on 1 to 3 percent slopes and low on 3 to 5 percent slopes
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and strongly acid to neutral in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: High
Hazard of wind erosion: High

Inclusions

- Chaney and Duffau soils in the lower landscape positions and in drainageways
- Windthorst soils on the lower ridgetops
- Wise soils on the higher ridgetops

Use and Management

Main Uses: Pasture and rangeland

Rangeland

The climax plant community is a post oak savannah. The mid-grass understory is dominantly sideoats grama. Because of past grazing practices, Texas wintergrass, buffalograss, threeawn, silver bluestem, and mesquite are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, turkeys, and deer. Where woody plants are more prevalent, numbers of deer and turkeys are higher. Forbs and browse provide much of the wildlife food. Planting winter food plots of small grains, managing livestock grazing, and seeding grasses, forbs, and legumes for food and cover improve wildlife habitat.

Interpretive Groups

Land capability subclass: IVe
Range site: Tight Sandy Loam

KtC2—Keeter very fine sandy loam, 2 to 6 percent slopes, eroded

Composition

Keeter soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Convex ridgetops
Slope class: Gently sloping
Shape of areas: Irregular to elongated
Size of areas: 10 to about 50 acres

Typical Profile

Surface layer:
0 to 3 inches—light brown very fine sandy loam

Subsoil:
3 to 15 inches—red clay loam
15 to 25 inches—reddish yellow sandy clay loam

Underlying material:
25 to 80 inches—light gray unconsolidated sand

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low on slopes of 2 to 3 percent and low on slopes of 3 to 6 percent
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and strongly acid to neutral in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: High
Hazard of wind erosion: High
Other features: Most areas are formerly cultivated fields where erosion has removed most of the surface layer and exposed the reddish subsoil; shallow gullies, mainly less than 2 feet deep, and rills cross the more sloping areas

Inclusions

- Chaney and Duffau soils in the lower landscape positions and in drainageways
- Windthorst soils on the lower ridgetops
- Wise soils on the higher ridgetops

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a post oak savannah. The mid-grass understory is dominantly sideoats grama. Because of past grazing practices, Texas wintergrass, buffalograss, threeawn, silver bluestem, and mesquite are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, turkeys, and deer. The number of deer and turkeys is higher where woody vegetation is more prevalent. Forbs and browse provide much of the wildlife food. Planting winter food plots of small grains, managing livestock grazing, and seeding grasses, forbs, and legumes for food and cover improve wildlife habitat.

Interpretive Groups

Land capability subclass: IVe
Range site: Tight Sandy Loam

LDF—Landfill

This map unit consists of areas of accumulated waste products of human habitation that can be above or below natural ground level.

This map unit is not assigned a land capability subclass or a range site.

LeA—Leeray clay, 0 to 1 percent slopes

Composition

Leeray soil: About 90 percent
Inclusions: About 10 percent

Setting

Landscape: Uplands
Slope class: Nearly level
Shape of areas: Irregular to oblong
Size of areas: About 8 to 60 acres

Typical Profile

Surface layer:
0 to 21 inches—dark grayish brown clay

Subsoil:
21 to 42 inches—dark brown clay
42 to 52 inches—grayish brown clay
52 to 80 inches—light olive brown clay

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Very slow, except when the soil is dry and cracks are open
Drainage class: Well drained
Runoff: Low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately alkaline
Shrink-swell potential: Very high
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Other features: Untilled areas have gilgai microrelief

Inclusions

- Hassee soils in the slightly lower landscape positions
- Thurber soils in the slightly higher landscape positions

Use and Management

Main Use: Cropland

Rangeland

The climax plant community is an open prairie of mid grasses, consisting primarily of sideoats grama, vine mesquite, buffalograss, and white tridens. Because of past grazing practices, silver bluestem, buffalograss, threeawn, Texas wintergrass, mesquite, lotebush, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, Wilman lovegrass, and johnsongrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. Plants supply adequate food but provide poor cover. Planting woody vegetation, such as plum, and managing livestock grazing improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIs
Range site: Clayey Upland

LeB—Leeray clay, 1 to 3 percent slopes

Composition

Leeray soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Uplands
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 10 to 130 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray clay

Subsoil:
9 to 26 inches—dark grayish brown clay
26 to 64 inches—grayish brown clay
64 to 80 inches—brownish clay

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Very slow, except when the soil is dry and cracks are open

Drainage class: Well drained
Runoff: Low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately alkaline
Shrink-swell potential: Very high
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Other features: Untilled areas have gilgai microrelief

Inclusions

- Hassee soils in landscape positions slightly lower than those of the Leeray soil
- Thurber soils in the slightly higher landscape positions

Use and Management

Main Use: Cropland

Rangeland

The climax plant community is an open prairie of mid grasses, consisting primarily of sideoats grama, vine mesquite, buffalograss, and white tridens. Because of past grazing practices, silver bluestem, buffalograss, threeawn, Texas wintergrass, mesquite, lotebush, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, Wilman lovegrass, and johnsongrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. Plants supply adequate food but provide poor cover. Planting small scattered areas of woody vegetation, such as plum, enhances wildlife habitat. Proper livestock grazing practices are also beneficial to wildlife.

Interpretive Groups

Land capability subclass: IIe
Range site: Clayey Upland

MwB—Minwells fine sandy loam, 1 to 3 percent slopes

Composition

Minwells soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: High terraces
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 10 inches—dark brown fine sandy loam

Subsoil:
10 to 35 inches—red sandy clay
35 to 45 inches—reddish yellow sandy clay loam

Underlying material:
45 to 60 inches—yellowish red very gravelly sandy loam

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and neutral to moderately alkaline in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Bonti soils that have sandstone at a depth of less than 40 inches, in landcape positions slightly higher than those of the Minwells soil
- Truce and Winters soils in the slightly lower landscape positions

Use and Management

Main Use: Rangeland, because of the small size of the areas

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses dominated by little bluestem. Because of past grazing practices, some areas have a dense canopy of oaks and the amount of low-growing woody vegetation and less desirable grasses has increased. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, deer, turkeys, and squirrels. Deer, turkeys, and squirrels are more abundant where woody vegetation provides feeding and escape cover. Other small mammals and birds feed, rest, and raise their young in areas of this map unit. Forbs, browse, mast, and seed-producing grasses provide adequate food for wildlife. Managing livestock grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIe
Range site: Sandy Loam

OwE—Owens clay, 5 to 25 percent slopes, very stony

Composition

Owens soil: About 70 percent
Inclusions: About 30 percent

Setting

Landscape: Sides of hills and escarpments, generally on south-facing slopes
Slope class: Strongly sloping to steep
Shape of areas: Irregular
Size of areas: 15 to 150 acres

Typical Profile

Surface layer:
0 to 7 inches—grayish brown clay

Subsoil:
7 to 18 inches—light yellowish brown clay

Underlying material:
18 to 80 inches—mottled light olive brown and grayish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: Low
Permeability: Very slow
Drainage class: Well drained
Runoff: Very high
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Moderately alkaline
Shrink-swell potential: High
Hazard of water erosion: High
Hazard of wind erosion: Slight
Rock fragments: Limestone and sandstone fragments 10 to 24 inches across and 2 to 24 inches thick cover 5 to 15 percent of the surface; rock fragments less than 10 inches across cover 3 to 10 percent of the surface

Inclusions

- Set and Truce soils that are lower on the landscape than the Owens soil
- Shatruce and Vernon soils that are higher on the landscape than the Owens soil
- Small areas of exposed shale material, extremely stony spots, and rock outcrops

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is mid and short grasses, dominantly sideoats grama, and an open savannah of scattered woody plants. Because of past grazing practices, buffalograss, tridens, hairy grama, Texas grama, mesquite, lotebush, pricklypear, and juniper are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too steep and has too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the slope, low available water capacity, and stones on the surface.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. The rough terrain also attracts rattlesnakes. The scarcity of food and cover are the limiting factors for deer habitat. Because excessive grazing by livestock reduces the amount of food and cover for wildlife, proper grazing practices are essential for wildlife habitat management.

Interpretive Groups

Land capability subclass: VIIs
Range site: Rocky Hill

PaB—Palopinto loam, 1 to 4 percent slopes, extremely stony

Composition

Palopinto soil: About 75 percent
Inclusions: About 25 percent

Setting

Landscape: Uplands
Slope class: Gently sloping
Shape of areas: Elongated to irregular
Size of areas: 50 to 1,000 acres

Typical Profile

Surface layer:
0 to 10 inches—reddish brown extremely stony loam

Underlying material:
10 to 60 inches—coarsely fractured, indurated limestone

Soil Properties and Qualities

Available water capacity: Low
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low
Depth class: Very shallow or shallow
Root zone: Very shallow or shallow
Soil reaction: Neutral to moderately alkaline
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate
Rock fragments: Limestone fragments 10 to 24 inches across and 1 to 10 inches thick cover 15 to 50 percent of the surface; less than 1 percent of the surface is covered by fragments larger than 24 inches across

Inclusions

- Hensley and Rowden soils in concave areas on ridgetops
- Set soils on side slopes along drainageways
- Some areas that have long and narrow escarpments and slopes of more than 8 percent

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a live oak savannah. The understory is dominantly little bluestem. Because of past grazing practices, buffalograss, Texas wintergrass, hairy tridens, Texas grama, mesquite, pricklypear, and agarito are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too shallow and has too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland, mainly because it is shallow to bedrock, has a low available water capacity, and has stones on the surface.

Wildlife habitat

Areas of this soil are inhabited by quail, doves, and small mammals. The rough terrain also attracts rattlesnakes. Deer and turkeys may inhabit areas along water courses where woody vegetation, such as live oak, hackberry, and elm, grow. Managing livestock grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: VIs
Range site: Low Stony Hill

Pt—Pits, limestone

Setting

This map unit consists of areas where limestone has been mined. The areas are comprised of piles of overburden that was removed to get to the limestone, large stockpiles of crushed limestone, and excavated pits. Depth of the pits ranges from about 8 feet to more than 100 feet. The overburden is clay, shale, and loam mixed with limestone rocks. Areas range from 8 to more than 200 acres in size.

Most of the pits remain open because little effort has been made to reclaim them. Some pits are being mined and are increasing in size. Some pits may contain water.

Use and Management

Rangeland

This map unit has a very limited capacity to grow plants and has no rangeland interpretations.

Pasture

This map unit cannot be managed for pasture grasses.

Cropland

This map unit cannot be cultivated.

Wildlife habitat

Areas of this map unit generally are too small in size to benefit wildlife. The main wildlife using areas of this unit are some birds. For short periods, some areas contain water, which wildlife can use.

Interpretive Groups

Land capability subclass: VIIIs
Range site: None assigned

Pu—Pulexas fine sandy loam, occasionally flooded

Composition

Pulexas soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Flood plains
Slope class: Nearly level; slopes mainly are 0 to 1 percent but range to 2 percent in some areas
Shape of areas: Areas are longer than they are wide
Size of areas: 12 to about 400 acres

Typical Profile

Surface layer:
0 to 15 inches—light brownish gray fine sandy loam

Underlying material:
15 to 35 inches—light brown fine sandy loam
35 to 50 inches—yellowish brown fine sandy loam
50 to 80 inches—light yellowish brown loam

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderately rapid
Drainage class: Well drained
Runoff: Negligible
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and slightly acid to moderately alkaline in the underlying material
Shrink-swell potential: Low
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate
Flooding: About once every 2 to 20 years for extremely brief periods

Inclusions

- Bastsil soils on terraces and along the outer edges of the flood plain, in positions higher on the landscape than the Pulexas soil
- Bosque and Gowen soils that are finer textured than the Pulexas soil, in the slightly lower landscape positions
- A few low-lying areas of Pulexas soils that are frequently flooded
- Because of flooding, some areas that have various amounts of soils with loamy surface layers
- Some areas that have a buried soil below a depth of 35 inches

Use and Management

Main Use: Rangeland, because of the long, narrow shape of mapped areas

Rangeland

The climax plant community is tall grasses, dominantly switchgrass, indiangrass, big bluestem, and little bluestem. Trees, vines, and scattered browse are common. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, kleingrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth. The major limitation is the hazard of flooding. Pecan trees grow well on this soil.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, squirrels, doves, quail, and furbearers. Numerous reptiles and amphibians are also present. Turkeys commonly use the larger trees for roosting. Many choice plants provide food for deer and turkeys. This soil provides areas for resting, nesting, and escape. Managing livestock grazing improves wildlife habitat. Food plots of small grains provide food for deer and turkeys.

Interpretive Groups

Land capability subclass: IIw
Range site: Loamy Bottomland

Px—Pulexas fine sandy loam, frequently flooded

Composition

Pulexas soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Flood plains
Slope class: Nearly level; slopes mainly are 0 to 1 percent but range to 2 percent in some areas
Shape of areas: Areas are long and narrow and commonly include the entire flood plain of smaller streams
Size of areas: 30 to 200 acres

Typical Profile

Surface layer:
0 to 20 inches—very pale brown fine sandy loam
Underlying material:
20 to 37 inches—light yellowish brown fine sandy loam
37 to 80 inches—dark grayish brown loam

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderately rapid
Drainage class: Well drained
Runoff: Negligible
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and neutral to moderately alkaline in the underlying material
Shrink-swell potential: Low
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate
Flooding: Once every 1 to 2 years for very brief periods

Inclusions

- Bastsil soils on terraces and along the outer edges of the flood plain, in positions higher on the landscape than the Pulexas soil
- Bosque and Gowen soils that are finer textured than the Pulexas soil, in the slightly lower landscape positions
- Some areas that are fine sandy loam, loamy fine sand, loam, or clay loam because of new sediments that are deposited by each flood
- Some areas that have a buried soil below a depth of 35 inches

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is mainly tall grasses, dominantly switchgrass, indiangrass, big bluestem, and little bluestem. Trees, vines, and scattered browse are common. Because of past grazing practices, Texas wintergrass, buffalograss, silver bluestem, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, kleingrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

This soil is not recommended for use as cropland, mainly because of the frequent flooding. Pecan trees, however, grow well on this soil.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, squirrels, doves, quail, and furbearers. Numerous reptiles and amphibians are also present. Turkeys commonly use the larger trees for roosting. Many choice plants provide food for deer and turkeys. This soil provides areas for resting, nesting, and escape. Managing livestock grazing improves wildlife habitat. Food plots of small grains provide food for deer and turkeys.

Interpretive Groups

Land capability subclass: Vw
Range site: Loamy Bottomland

RwB—Rowden loam, 0 to 2 percent slopes

Composition

Rowden soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Mainly smooth or convex slopes on uplands
Slope class: Very gently sloping
Shape of areas: Oblong to irregular
Size of areas: 10 to 160 acres

Typical Profile

Surface layer:
0 to 16 inches—dark brown loam

Subsoil:
16 to 30 inches—reddish brown clay
30 to 38 inches—red clay

Underlying material:
38 to 58 inches—hard, fractured limestone

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Neutral to moderately alkaline in the surface layer and slightly alkaline or moderately alkaline in the subsoil
Shrink-swell potential: High in the subsoil
Hazard of water erosion: Slight
Hazard of wind erosion: Moderate

Inclusions

- Hassee soils that are underlain by clay, in the lower, concave areas
- Hensley and Palopinto soils that are slightly higher on the landscape than the Rowden soil
- Truce soils that are underlain by shale that has clay texture, in the more sloping areas

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is an open prairie of mid grasses, dominantly sideoats grama, vine mesquite, and little bluestem. Because of past grazing practices, buffalograss, threeawn, Texas wintergrass, lotebush, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, johnsongrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, doves, and quail. Several of the woody plants, forbs, and grasses that are endemic to this soil provide browse, mast, seeds, and cover for wildlife. Deer and turkeys are more abundant where woody vegetation provides good escape and resting cover. Managing livestock grazing; seeding grasses, forbs, and

legumes; and planting woody vegetation for food and cover improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Clay Loam

SdB—Selden loamy fine sand, 1 to 3 percent slopes

Composition

Selden soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Concave areas on uplands
Slope class: Very gently sloping
Shape of areas: Irregular to oval
Size of areas: 7 to about 120 acres

Typical Profile

Surface layer:
0 to 8 inches—light yellowish brown loamy fine sand

Subsurface layer:
8 to 14 inches—very pale brown loamy fine sand

Subsoil:
14 to 26 inches—brownish yellow sandy clay loam
26 to 62 inches—sandy clay loam that is coarsely mottled in shades of red, brown, yellow, and gray
62 to 80 inches—very pale brown fine sandy clay loam

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Moderately slow
Drainage class: Moderately well drained
Runoff: Very low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately acid to neutral in the surface and subsurface layers and strongly acid to neutral in the subsoil
Shrink-swell potential: Low
Hazard of water erosion: Moderate
Hazard of wind erosion: High

Inclusions

• Small areas of Chaney, Duffau, and Windthorst soils that are higher on the landscape than the Selden soil

Use and Management

Main Use: Cropland

Rangeland

The climax plant community is made up of tall and mid grasses on an open savannah along with scattered stands of post oak and blackjack oak. Because of past grazing practices, mid and short grasses, such as silver bluestem, tall dropseed, sand dropseed, Texas wintergrass, and threeawn, and dense stands of oak with greenbrier are dominant in some areas. Proper stocking and controlled grazing are necessary to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, big bluestem, indiangrass, johnsongrass, switchgrass, and weeping lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production. The intake of moisture is rapid in the surface and subsurface layers and moderate or slow in the subsoil.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, doves, quail, and squirrels. These animals feed extensively on acorns and other mast, crop residue, and winter cover crops. Other small animals and birds feed and raise their young in areas of this map unit. Managing livestock grazing, controlling brush in patterns, and seeding plants for food and cover improve wildlife habitat. Food plots of small grains planted in association with woody cover are also beneficial.

Interpretive Groups

Land capability subclass: IIIe
Range site: Loamy Sand

SeC—Set clay, 3 to 5 percent slopes

Composition

Set soil: About 90 percent
Inclusions: About 10 percent

Setting

Landscape: Knolls and hillslopes
Slope class: Gently sloping
Shape of areas: Long and narrow to oblong
Size of areas: 15 to 70 acres

Typical Profile

Surface layer:
0 to 14 inches—dark grayish brown clay

Subsoil:
14 to 32 inches—brown silty clay
32 to 48 inches—yellowish brown silty clay

Underlying material:
48 to 80 inches—grayish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: High
Permeability: Very slow
Drainage class: Well drained
Runoff: Medium
Depth class: Very deep
Root zone: Very deep
Soil reaction: Moderately alkaline
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Aledo, Palopinto, and Rowden soils that are underlain by limestone, on the upper slope breaks
- Leeray and Thurber soils in the lower, less sloping areas
- Owens soils that have unweathered clay or shale at a depth of less than 40 inches, in landscape positions similar to those of the Set soil

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is an open prairie of mid grasses, dominantly sideoats grama, vine mesquite, and little bluestem. Because of past grazing practices, buffalograss, threeawn, Texas wintergrass, lotebush, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, johnsongrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. Deer and turkeys use the areas for feeding where escape or resting cover is near. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody vegetation, such as plum, enhance wildlife habitat. Managing livestock grazing can maintain the quality of wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Clay Slopes

SeE—Set-Palopinto complex, 8 to 30 percent slopes, very stony

Composition

Note: These soils are so intricately mingled that separating them in mapping is not practical at the scale used.
Set soil: About 50 percent
Palopinto soil: About 35 percent
Inclusions: About 15 percent

Setting

Landscape: Ridges at the highest elevations
Slope class: Gently sloping to steep
Shape of areas: Subrounded to oblong
Size of areas: 10 to about 450 acres

Typical Profile

Set

Surface layer:
0 to 12 inches—brown gravelly silty clay

Subsoil:
12 to 27 inches—light yellowish brown silty clay

27 to 42 inches—light brownish gray silty clay
42 to 51 inches—light yellowish brown silty clay

Underlying material:
51 to 80 inches—grayish brown clay

Palopinto

Surface layer:
0 to 6 inches—brown loam

Subsoil:
6 to 14 inches—brown gravelly clay loam

Underlying material:
14 to 40 inches—indurated coarsely fractured limestone that is interbedded with layers of weakly cemented limestone and marl

Soil Properties and Qualities

Available water capacity: Set—high; Palopinto—low
Permeability: Set—very slow; Palopinto—moderate
Drainage class: Well drained
Runoff: High on slopes of 8 to 20 percent and very high on slopes of more than 20 percent
Depth class: Set—very deep; Palopinto—very shallow
Root zone: Set—very deep; Palopinto—very shallow or shallow
Soil reaction: Set—moderately alkaline; Palopinto—neutral
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight
Rock fragments: Limestone fragments 10 to 24 inches across and 2 to 10 inches thick cover 5 to 15 percent of the surface; limestone fragments less than 10 inches across and less than 5 inches thick cover 2 to 5 percent of the surface
Other features: The Set soil is underlain by beds of shale at a depth of more than 40 inches and the Palopinto soil is underlain by fractured limestone at a depth of less than 20 inches; the Set soil occurs at random and is typically on ridgetops and lower on the landscape than the Palopinto soil; in some areas the Palopinto soil occurs at random on mid slopes

Inclusions

- Aledo soils in the slightly higher landscape positions
- Leeray soils in the lower, less sloping areas
- Owens soils in landscape positions similar to those of the Set and Palopinto soils
- Areas of a soil that is similar to the Set soil but that has a layer of soft sandstone or limestone within a depth of 5 feet
- Vertical limestone cliffs and large boulders that are along the upper edge of escarpments and that make up about 5 percent of some delineations

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of oak and ash trees. The understory is tall and mid grasses, dominantly little bluestem. Because of past grazing practices, Texas wintergrass, buffalograss, Scribner panicum, Texas grama, mesquite, lotebush, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

These soils are not recommended for use as improved pasture. They are too steep and have too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

These soils are not recommended for use as cropland. The major limitations are the slope and stones on the surface.

Wildlife habitat

Areas of these soils are inhabited by quail, doves, and small mammals. The rough terrain also attracts rattlesnakes. Deer and turkeys inhabit areas along water courses where woody vegetation, such as live oak, hackberry, and elm, grow. Proper management of grazing and brush control benefit wildlife habitat.

Interpretive Groups

Land capability subclass: VIIs
Range site: Set—Clay Loam Slope; Palopinto—Steep Rocky

ShF—Shatruce gravelly fine sandy loam, 8 to 30 percent slopes, very stony

Composition

Shatruce soil: About 65 to 85 percent
Inclusions: About 15 to 35 percent

Setting

Landscape: Strongly sloping to steep hillsides and narrow stream divides

Shape of areas: Elongated to subrounded
Size of areas: 15 to 2,000 acres

Typical Profile

Surface layer:
0 to 4 inches—dark grayish brown gravelly fine sandy loam

Subsurface layer:
4 to 7 inches—brown gravelly fine sandy loam

Subsoil:
7 to 20 inches—yellowish red clay
20 to 32 inches—yellowish brown clay

Underlying material:
32 to 80 inches—light yellowish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: Low
Permeability: Slow
Drainage class: Well drained
Runoff: High on slopes of 8 to 20 percent and very high on slopes of more than 20 percent
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Slightly acid or neutral in the surface layer and strongly acid to slightly acid in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight
Rock fragments: Sandstone or sandstone conglomerate fragments 10 to 24 inches across and 5 to 24 inches thick cover 5 to 15 percent of the surface; boulders cover less than 1 percent of the surface

Inclusions

- Bonti soils in areas where thin strata of sandstone outcrop
- Owens soils that consist of small rounded clay spots in positions similar to those of the Shatruce soil
- Truce soils that are closely similar to the Shatruce soil, on the less sloping footslopes
- Exray and Darnell soils that are on ridgetops, side slopes, or the top edge of escarpments
- Narrow bands of Cona soils that have slopes of as much as 30 percent
- In some areas, a narrow band of boulders as much as 6 feet across that outcrops on edges of ridgetops or at mid slope

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is an open stand of mostly post oak trees. The understory of mid and tall grasses is dominantly little bluestem. Because of past grazing practices, woody species, such as post oak, elm, greenbrier, mesquite, and skunkbush, are dominant in some areas. Little bluestem still occurs; however, many lower successional grasses, such as threeawn and dropseed, are also present. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too steep and has too many stones. If this map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the slope and surface stones.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, quail, and doves. Woody species provide good cover. Continuous overgrazing has caused oak and elm trees to increase in abundance and grasses and forbs to decrease. Managing livestock grazing and controlling brush in patterns improve wildlife habitat. Establishing winter food plots enhances the habitat for deer.

Interpretive Groups

Land capability subclass: VIIs
Range site: Sandstone Hill

ShG—Shatruce gravelly fine sandy loam, 12 to 50 percent slopes, extremely bouldery

Composition

Shatruce soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Hillsides and escarpments
Slope class: Steep or very steep
Shape of areas: Narrow and long
Size of areas: 100 to 1,000 acres

Figure 8.—Boulders limit the use and access of Shatruce gravelly fine sandy loam, 12 to 50 percent slopes, extremely bouldery.

Typical Profile

Surface layer:
0 to 3 inches—dark grayish brown gravelly fine sandy loam

Subsurface layer:
3 to 6 inches—light yellowish brown fine sandy loam

Subsoil:
6 to 25 inches—yellowish red clay
25 to 35 inches—light reddish brown clay

Underlying material:
35 to 80 inches—light yellowish brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: Low
Permeability: Slow
Drainage class: Well drained
Runoff: High on slopes of 12 to 20 percent and very high on slopes of more than 20 percent
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Slightly acid or neutral in the surface layer and strongly acid to slightly acid in the subsoil
Shrink-swell potential: High in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight
Rock fragments: Boulders and stones cover 30 to 50 percent of the surface (fig. 8)

Inclusions

- Bonti, Darnell, and Exray soils that are in the higher and less sloping landscape positions
- Owens soils on eroded side slopes

- Truce soils on the lower and less sloping toeslopes
- Vertical sandstone cliffs and rock outcrops that make up less than 1 percent of delineations

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is dominantly little bluestem, post oak, and some skunkbush. Because of past grazing practices, post oak, skunkbush, greenbrier, threeawn, dropseed, pricklypear, and scattered amounts of little bluestem are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for use as improved pasture. It is too steep and has too many stones and boulders. If the map unit is used as pasture, proper grazing management practices are needed and native plants should be introduced if none are present.

Cropland

This soil is not recommended for use as cropland mainly because of the slope and surface stones and boulders.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, and quail. This map unit provides good nesting areas for doves and songbirds. The rough terrain also attracts rattlesnakes. Forbs and browse are the primary food sources.

Interpretive Groups

Land capability subclass: VIIs
Range site: Bouldery Hill

StC—Stephenville fine sandy loam, 1 to 5 percent slopes

Composition

Stephenville soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Convex areas on uplands
Slope class: Gently sloping or undulating
Shape of areas: Elongated or oblong
Size of areas: 6 to about 150 acres

Typical Profile

Surface layer:
0 to 8 inches—brown fine sandy loam

Subsoil:
8 to 18 inches—yellowish red sandy clay loam
18 to 25 inches—reddish brown sandy clay loam

Underlying material:
25 to 45 inches—strong brown weakly cemented sandstone that becomes harder as depth increases

Soil Properties and Qualities

Available water capacity: Low
Permeability: Moderate
Drainage class: Well drained
Runoff: Very low on slopes of 1 to 3 percent and low on slopes of 3 to 5 percent
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Moderately acid or slightly acid
Shrink-swell potential: Low
Hazard of water erosion: Moderate
Hazard of wind erosion: High

Inclusions

- Bastsil, Chaney, and Truce soils on the lower side slopes
- Bonti soils in landscape positions similar to those of the Stephenville soil
- Darnell and Exray soils that have sandstone at a depth of less than 20 inches, in the slightly higher landscape positions
- Truce soils that are underlain by shale, on the lower side slopes
- A few areas where slopes are as much as 10 percent

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, some areas have a dense canopy of oaks, low-growing woody vegetation, and less desirable grasses. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are

bermudagrass, big bluestem, yellow bluestem, indiangrass, johnsongrass, Wilman lovegrass, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, deer, turkeys, and squirrels. Deer, turkeys, and squirrels are more abundant where woody vegetation provides feeding and escape cover. Other small mammals and birds feed, rest, and raise their young in these areas. Forbs, browse, mast, and seed-producing grasses provide adequate food for wildlife. Managing grazing and controlling brush can enhance wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Sandy Loam

ThA—Thurber clay loam, 0 to 2 percent slopes

Composition

Thurber soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Slightly concave, broad upland footslopes
Slope class: Nearly level
Shape of areas: Irregular or oblong
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—dark grayish brown clay loam

Subsoil:
6 to 24 inches—dark grayish brown clay
24 to 41 inches—grayish brown clay
41 to 50 inches—brown clay
50 to 80 inches—light yellowish brown clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Very slow
Drainage class: Moderately well drained
Runoff: Medium
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid to slightly alkaline in the surface layer and neutral to moderately alkaline in the subsoil
Shrink-swell potential: High
Hazard of water erosion: Slight
Hazard of wind erosion: Slight

Inclusions

- Anocon, Bluegrove, Leeray, and Truce soils that are higher on the landscape than the Thurber soil
- Hassee soils in the slightly lower landscape positions

Use and Management

Main Use: Cropland

Rangeland

The climax plant community is an open prairie of mid and short grasses, dominantly sideoats grama. Because of past grazing practices, silver bluestem, buffalograss, mesquite, pricklypear, and lotebush are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control (fig. 9), controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and rabbits. A good selection of forbs is available for deer forage but little cover is provided for escape and

Figure 9.—An area of Thurber clay loam, 0 to 2 percent slopes. Grass production has been greatly increased in this area by removing brush.

resting. Numerous annual and perennial plants provide food and cover for birds. Planting woody plants; seeding grasses, forbs, and legumes; and managing livestock grazing improve wildlife habitat. Small grains provide winter food for deer.

Interpretive Groups

Land capability subclass: IIIe
Range site: Claypan Prairie

TrA—Treadway silty clay loam, 0 to 2 percent slopes

Composition

Treadway soil: About 90 percent
Inclusions: About 10 percent

Setting

Landscape: Areas below erosional slopes
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 11 inches—reddish brown silty clay loam

Subsoil:
11 to 34 inches—yellowish red clay

Underlying material:
34 to 60 inches—reddish brown clay

Soil Properties and Qualities

Available water capacity: Low
Permeability: Very slow
Drainage class: Well drained
Runoff: Medium
Depth class: Very deep
Root zone: Shallow
Soil reaction: Moderately alkaline
Shrink-swell potential: High

Hazard of water erosion: High
Hazard of wind erosion: Moderate

Inclusions

- Bluegrove soils that have sandstone at a depth of less than 40 inches, in the higher landscape positions
- Owens soils in landscape positions similar to those of the Treadway soil

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is an open prairie of mid and short grasses, dominantly buffalograss and vine mesquite. Because of past grazing practices, buffalograss, threeawn, mesquite, pricklypear, and lotebush are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

This soil is not recommended for improved grasses. It is too salty and has a low available water capacity.

Cropland

This soil is not recommended for use as cropland. It is too salty and has a low available water capacity.

Wildlife habitat

Areas of this soil are inhabited by doves and quail. Deer and turkeys feed on forbs in areas of this map unit but use areas of adjacent soils for cover. Managing livestock grazing and seeding grasses, forbs, and legumes improve wildlife habitat. Providing small patchwork plantings of woody plants that provide food and cover increases vegetative diversity.

Interpretive Groups

Land capability subclass: VIs
Range site: Clay Flat

TuC—Truce fine sandy loam, 1 to 5 percent slopes

Composition

Truce soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Upland ridges
Slope class: Gently sloping
Shape of areas: Elongated
Size of areas: About 6 to 80 acres

Typical Profile

Surface layer:
0 to 6 inches—light brown fine sandy loam

Subsoil:
6 to 25 inches—reddish brown clay
25 to 32 inches—brown clay
32 to 43 inches—yellowish brown clay

Underlying material:
43 to 65 inches—light olive brown shale that has clay texture

Soil Properties and Qualities

Available water capacity: Low
Permeability: Slow
Drainage class: Well drained
Runoff: Medium
Depth class: Deep
Root zone: Deep
Soil reaction: Slightly acid or neutral in the surface layer and neutral to moderately alkaline in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Anocon and Kamay soils in the higher and less sloping areas
- Bonti soils that have sandstone at a depth of less than 40 inches, in the higher and less sloping areas
- Owens soils that are higher on the landscape than the Truce soil and on the steeper side slopes
- Thurber soils in the lower and less sloping areas
- Areas of eroded Truce soils that are too small to be delineated

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a post oak savannah. The mid-grass understory is dominantly sideoats grama. Because of past grazing practices, Texas wintergrass, buffalograss, threeawn, silver bluestem, and mesquite are dominant in some areas. Proper stocking (fig. 10) and controlled grazing

Figure 10.—An area of Truce fine sandy loam, 1 to 5 percent slopes, is in the foreground. This soil can be very productive with proper stocking. Exray-Darnell complex, 1 to 8 percent slopes, very stony, in the background, can also be very productive with proper stocking.

are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, turkeys, and deer. Numbers of deer and turkeys are higher where woody vegetation is more prevalent. Forbs and browse provide much of the wildlife food. Planting winter food plots of small grains enhances wildlife habitat. Managing livestock grazing and seeding grasses, forbs, and legumes for food and cover improve wildlife habitat.

Interpretive Groups

Land capability subclass: IVe
Range site: Tight Sandy Loam

VrC—Vernon clay, 3 to 8 percent slopes

Composition

Vernon soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Uplands
Slope class: Gently sloping or strongly sloping
Shape of areas: Oblong to irregular
Size of areas: 5 to about 120 acres

Typical Profile

Surface layer:
0 to 6 inches—reddish brown clay

Subsoil:
6 to 34 inches—reddish brown clay

Underlying material:
34 to 60 inches—weak red shale that has clay texture

Soil Properties and Qualities

Available water capacity: Low
Permeability: Very slow
Drainage class: Well drained
Runoff: High on slopes of 3 to 5 percent and very high on slopes of 5 to 8 percent
Depth class: Moderately deep
Root zone: Moderately deep
Soil reaction: Moderately alkaline
Shrink-swell potential: High
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight

Inclusions

- Keeter, Windthorst, and Wise soils that are higher on the landscape than the Vernon soil
- Owens soils on the steeper side slopes
- Truce soils in landscape positions similar to those of the Vernon soil
- A few areas where calcareous, reddish, clayey geologic materials are exposed
- Some areas that have a few uncrossable gullies

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community consists mainly of short grasses and scattered mid grasses. Sideoats grama is the dominant grass. Because of past grazing practices, buffalograss, threeawn, mesquite, pricklypear, and lotebush are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, johnsongrass, and blue panicum. Applications of fertilizer, weed control, brush control, and controlled grazing are needed for maximum production.

Cropland

This soil is not recommended for use as cropland.

Wildlife habitat

Areas of this soil are inhabited by doves and quail. Deer and turkeys feed on forbs in areas of this soil and use areas of adjacent soils for cover. Managing livestock grazing and seeding grasses, forbs, and legumes improve wildlife habitat. Providing small patchwork plantings of woody plants that provide food and cover increases plant diversity.

Interpretive Groups

Land capability subclass: VIe
Range site: Shallow Clay

W—Water

This map unit consists of small, natural or constructed lakes, ponds, or pits that contain water most of the year.

This map unit is not assigned a land capability subclass or a range site.

Wf—Westfork silty clay, frequently flooded

Composition

Westfork soil: About 85 percent
Inclusions: About 15 percent

Setting

Landscape: Flood plains of large streams
Slope class: Nearly level; slopes are 0 to 1 percent
Shape of areas: Areas are longer than they are wide

Typical Profile

Surface layer:
0 to 21 inches—reddish brown silty clay
21 to 40 inches—brown silty clay

Subsoil:
40 to 80 inches—reddish brown silty clay

Soil Properties and Qualities

Available water capacity: Moderate
Permeability: Very slow
Drainage class: Well drained
Runoff: Low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid to slightly alkaline in the surface layer and slightly alkaline or moderately alkaline in the subsoil
Shrink-swell potential: High
Hazard of water erosion: Slight
Hazard of wind erosion: Slight
Flooding: Every 1 or 2 years for brief periods

Inclusions

- Small areas of Gowen, Thurber, and Pulexas soils
- A few areas that have a buried horizon below a depth of 40 inches that is stratified with loamy and clayey material

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of several kinds of trees. The understory is tall and mid grasses, mainly sideoats grama, and shrubs, vines, sedges, and forbs. Because of past grazing practices, buffalograss, annual cool-season grasses, and some mesquite, lotebush, tasajillo, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, johnsongrass, yellow bluestem, blue panicum, and switchgrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

This soil is not recommended for use as cropland mainly because of the hazard of frequent flooding.

Wildlife habitat

Areas of this soil are inhabited by deer, turkeys, doves, quail, squirrels, and furbearers. Waterfowl use sloughs and other areas for feeding and resting. Numerous reptiles and amphibians are also present. Browse, forbs, hard mast, and soft mast provide food for deer. Turkeys, quail, and doves feed on the mast and seeds produced by forbs and grasses. Squirrels feed mainly on hard and soft mast. Excessive grazing by livestock reduces the amount of food and cover available for wildlife. Plantings that provide food and cover enhance the numbers of wildlife. Small grains, such as wheat or rye, are recommended for wildlife food plots.

Interpretive Groups

Land capability subclass: Vw
Range site: Clayey Bottomland

WhC—Windthorst fine sandy loam, 1 to 5 percent slopes

Composition

Windthorst soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Ridges and side slopes of stream divides
Slope class: Gently sloping
Shape of areas: Elongated to oval
Size of areas: 20 to 300 acres

Typical Profile

Surface layer:
0 to 5 inches—yellowish brown fine sandy loam

Subsoil:
5 to 14 inches—red clay
14 to 23 inches—yellowish red clay
23 to 33 inches—strong brown sandy clay
33 to 44 inches—mottled yellowish red and pink sandy clay
44 to 58 inches—red sandy clay loam

Underlying material:
58 to 64 inches—pale yellow sandy clay loam
64 to 80 inches—very pale brown weakly cemented sandstone

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderately slow
Drainage class: Moderately well drained
Runoff: Very low on slopes of 1 to 3 percent and low on slopes of 3 to 5 percent
Depth class: Very deep
Root zone: Very deep

Soil reaction: Slightly acid or neutral in the surface layer and moderately acid to moderately alkaline in the subsoil
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Chaney, Duffau, and Selden soils that are lower on the landscape than the Windthorst soil
- Keeter, Vernon, and Wise soils that are higher on ridgetops than the Windthorst soil
- A few small areas of calcareous, reddish clay soils

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is a savannah of post oak and blackjack oak. The understory is mid and tall grasses, dominantly little bluestem. Because of past grazing practices, a dense canopy of oaks, low-growing woody plants, and less desirable grasses are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by deer, doves, and quail. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for wildlife. Interspersing small winter food plots in brushy areas enhances the habitat for deer as well as for other wildlife. Managing livestock grazing and controlling brush in patterns improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIIe
Range site: Sandy Loam

WnB—Winters loam, 1 to 3 percent slopes

Composition

Winters soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Uplands
Slope class: Very gently sloping
Shape of areas: Irregular
Size of areas: 10 to 60 acres

Typical Profile

Surface layer:
0 to 8 inches—reddish brown loam

Subsoil:
8 to 18 inches—reddish brown clay loam
18 to 25 inches—red clay
25 to 38 inches—yellowish red sandy clay
38 to 64 inches—reddish yellow sandy clay
64 to 80 inches—reddish yellow sandy clay loam

Soil Properties and Qualities

Available water capacity: High
Permeability: Moderately slow
Drainage class: Well drained
Runoff: Very low
Depth class: Very deep
Root zone: Very deep
Soil reaction: Slightly acid or neutral in the surface layer and slightly acid to moderately alkaline in the subsoil
Shrink-swell potential: Moderate in the subsoil
Hazard of water erosion: Moderate
Hazard of wind erosion: Moderate

Inclusions

- Anocon soils that are slightly higher on the landscape than the Winters soil
- Bastsil soils in the lower positions along stream terraces
- Hassee soils in depressional areas
- Truce soils along the steeper side slopes

Use and Management

Main Use: Cropland; however, areas of this map unit are gradually being converted to pasture

Rangeland

The climax plant community is an open prairie of mid grasses, dominantly sideoats grama, vine mesquite, and little bluestem. Because of past grazing practices, buffalograss, threeawn, Texas wintergrass, lotebush, mesquite, and pricklypear are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, johnsongrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Crop residue left on the surface helps to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, deer, turkeys, and squirrels. Deer, turkeys, and squirrels are more abundant where woody plants provide food and escape cover. Other small mammals and birds feed, rest, and raise their young in these areas. Forbs, browse, mast, and seed-producing grasses provide adequate food for wildlife. Managing livestock grazing and controlling brush improve wildlife habitat.

Interpretive Groups

Land capability subclass: IIe
Range site: Clay Loam

WsC—Wise loam, 3 to 5 percent slopes

Composition

Wise soil: About 80 percent
Inclusions: About 20 percent

Setting

Landscape: Low hills and nose slopes
Slope class: Gently sloping
Shape of areas: Oblong to elongated and following the contour of the landscape
Size of areas: 5 to about 50 acres

Typical Profile

Surface layer:
0 to 8 inches—brown loam

Subsoil:
8 to 17 inches—light yellowish brown clay loam
17 to 26 inches—pale brown clay loam

Underlying material:
26 to 60 inches—light gray silt loam

Soil Properties and Qualities

Available water capacity: Low
Permeability: Moderate
Drainage class: Well drained
Runoff: Medium
Depth class: Very deep
Root zone: Moderately deep
Soil reaction: Moderately alkaline
Shrink-swell potential: Moderate
Hazard of water erosion: Moderate
Hazard of wind erosion: Slight
Other features: Deep, uncrossable natural drains and a few large and deeply dissected gullies are in some areas; thin layers of limestone are in some areas

Inclusions

- Aledo soils that have limestone at a depth of less than 20 inches and are higher on the landscape than the Wise soil
- Duffau, Keeter, Vernon, and Windthorst soils that are lower on the landscape than the Wise soil
- A few areas of a previously cultivated Wise soil where most of the surface layer has eroded away
- A few areas of narrow upper slopes of more than 8 percent where the soil has a solum thinner than that of the Wise soil

Use and Management

Main Use: Rangeland

Rangeland

The climax plant community is mainly a savannah of tall and mid grasses, dominantly little bluestem, and live oaks. Because of past grazing practices, buffalograss, Texas wintergrass, Texas grama, threeawn, juniper, mesquite, elm, pricklypear, and agarito are dominant in some areas. Proper stocking and controlled grazing are needed to improve the plant

community and increase yields. Brush management is needed in some areas.

Pasture

The pasture grasses best adapted to this soil are bermudagrass, yellow bluestem, kleingrass, johnsongrass, blue panicum, and Wilman lovegrass. Weed control, brush control, controlled grazing, and applications of fertilizer are needed for maximum production.

Cropland

The major crops are grain sorghum, forage sorghum, and wheat. Areas planted to small grains are used mainly for winter grazing by livestock and are not harvested for grain. Terracing, contour farming, and leaving crop residue on the surface help to prevent soil erosion and conserve soil moisture. Planting legumes helps to improve soil fertility and tilth.

Wildlife habitat

Areas of this soil are inhabited by doves, quail, and small mammals. Deer and turkeys use these areas for food where escape or resting cover is near. Forbs and grasses provide a good food supply for wildlife. Scattered plantings of woody plants, such as plum, enhance wildlife habitat. Properly managed livestock grazing is needed to maintain habitat quality.

Interpretive Groups

Land capability subclass: IVe
Range site: Clay Loam

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland

In 1998, about 25,550 acres, or 4.3 percent of the county, was used for crops, mainly wheat, oats, and forage sorghum. Very few acres of row crops are grown in the county.

Some soils in Jack County are suited to increased production of food. Of the total acres of farmable land in the county, only a small percentage is cultivated. In addition to the reserve capacity of these soils, food production can also be increased considerably by applying the latest crop production technology to all cropland in the survey area.

The number of acres in cropland has been rapidly decreasing as more and more land is converted to permanent pasture or urban uses. In 1958, Jack County had almost 70 thousand acres of cropland and very little pasture. By 1967, the number of acres in cropland had decreased to about 28 thousand and the number of acres in pasture had increased to almost 19 thousand. By 1998, the number of acres in cropland had decreased to about 24 thousand and the number of acres in pasture had increased to almost 26 thousand.

Water erosion, a hazard if the slope is more than 1 percent, is the major concern on cropland in the county. Most soils have potential water erosion problems. Productivity is decreased when the surface layer is lost and part of the subsoil is incorporated into the plow layer. Erosion of the surface layer is especially damaging to soils that have a sandy or loamy surface layer and a clayey subsoil, such as Bonti and Truce soils. It is also damaging to soils that

have a restricted rooting depth because of bedrock. On these soils, not only is fertility reduced but the total available water capacity of the soils is also reduced. Hensley and Palopinto soils are underlain by limestone at a shallow depth.

In many sloping fields, preparing a good seedbed is difficult because of clayey spots where the original friable surface layer has eroded away. Such spots are common in areas of eroded Truce and Minwells soils.

Water erosion results in the sedimentation of streams, ponds, and reservoirs. Wind erosion causes air pollution. Sediment can also cover roads, fences, and crops. Effective erosion-control practices help to protect the quality of water, air, and fish and wildlife resources. They increase the rate of water infiltration, reduce the amount of surface runoff, and hold soil losses to amounts that can be tolerated without reducing productivity.

A cropping system that keeps a plant cover on the surface for extended periods helps to protect the soil from erosion. Using conservation tillage practices and returning crop residue to the soil help to increase water infiltration and prevent soil compaction and erosion. Leaving a good litter of crop residue on the soil surface protects the surface against heavy rainfall, minimizes crusting, slows the rate of surface runoff, and reduces the evaporation rate of soil moisture. The crop residue also shades the soil, thus reducing soil temperature. In addition, it adds organic matter to the soil and improves tilth. Crop residue needs to be protected from grazing and burning. On livestock farms, which require pasture and hay, including forage crops of legumes and grasses in the cropping system minimizes erosion, provides nitrogen, and improves soil tilth.

Farming on the contour and establishing parallel terraces and diversions are common practices used in Jack County to minimize erosion. Terraces and diversions reduce the length of slope and help to slow surface runoff as well as minimize erosion. They are most practical on deep or moderately deep soils that have regular slopes. Anocon, Bluegrove, and Truce soils are suited to terraces. Other soils in the county are less suitable because of steep slopes, a thick, sandy surface layer, bedrock at a depth of less than 20 inches, or flooding.

Wind erosion is a hazard on sandy Selden, Stephenville, and Bastsil soils. Strong winds can damage these soils in a few hours if they are not protected. Maintaining plant cover, surface mulch, or rough surfaces by proper tillage at timely intervals minimizes wind erosion. Leaving crop residue on the surface and stripcropping help to protect emerging seedlings.

Information on erosion-control practices for each kind of soil can be obtained at the local office of the Natural Resources Conservation Service.

Drainage is not a problem for growing crops on most of the soils in Jack County. Excess wetness on Hassee soils is a problem in some years because these soils are in depressional areas and have very slow permeability.

Soil fertility is naturally low in most of the light-colored, sandy or loamy soils on uplands. These soils are mainly slightly acid or neutral, and crops on these soils respond readily to fertilizer. Soils that have a sandy or loamy surface layer may need more than a single application of a complete fertilizer during the growing season to keep fertility in balance and replace nutrients lost through leaching. Soils on flood plains, such as Gowen, Bosque, and Westfork soils, are high in natural fertility. On all soils, the amount and kind of fertilizer and lime to be applied should be based on the results of soil tests, on the needs of the crop, on the expected level of yields, on the previous land use or cropping sequence, and on the amount of available soil moisture. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

Field crops suited to the soils and climate of the county include forage sorghum, wheat, barley, oats, and grain sorghum. Pecans are also grown. Other crops that are suitable but not grown in significant amounts are corn, guara, sunflowers, peanuts, millet, and watermelons.

The latest information and suggestions for growing specialty crops are available at the local office of the Cooperative Extension Service or the Natural Resources Conservation Service.

Pasture

In 1998, about 25,550 acres, or 4.3 percent of Jack County, was used for permanent pasture. Improved pasture grasses suited to the soils in the county include kleingrass, tall fescues, and several varieties of bermudagrass. Legumes, such as vetch, singletary peas, sweet clover, and arrowleaf clover, can be grown in pure stands but usually are interseeded in sod-forming grasses, such as bermudagrass. Major management practices for pasture include fertilizing, controlling weeds, and controlling grazing. The amount and kind of fertilizer to be applied should be based on the needs of the plant, on the desired level of production, and on the results of soil tests. Weeds are less likely to be a problem on properly grazed and well managed pasture. The population of desirable pasture

plants is reduced on overgrazed and poorly managed pastures.

Temporary pasture is used in many places to supplement permanent pasture or to produce hay. Sudangrass, sorghum-sudangrass crosses, and johnsongrass make good supplemental summer pasture. Small grains provide good supplemental winter forage.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the

soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 5 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

The map units in the survey area that are considered prime farmland are listed at the end of this section. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for prime farmland are:

AnB Anocon loam, 1 to 3 percent slopes
BaC Bastsil fine sandy loam, 1 to 5 percent slopes
BgB Bluegrove loam, 1 to 3 percent slopes (where irrigated)
BnB Bonti fine sandy loam, 1 to 3 percent slopes (where irrigated)
Bo Bosque clay loam, occasionally flooded
ChC Chaney loamy fine sand, 1 to 5 percent slopes (where irrigated)
DfC Duffau very fine sandy loam, 1 to 5 percent slopes (where irrigated)
Go Gowen loam, occasionally flooded
KaB Kamay loam, 1 to 3 percent slopes
LeA Leeray clay, 0 to 1 percent slopes
LeB Leeray clay, 1 to 3 percent slopes
MwB Minwells fine sandy loam, 1 to 3 percent slopes (where irrigated)
Pu Pulexas fine sandy loam, occasionally flooded
RwB Rowden loam, 0 to 2 percent slopes (where irrigated)
SdB Selden loamy fine sand, 1 to 3 percent slopes (where irrigated)
SeC Set clay, 3 to 5 percent slopes
StC Stephenville fine sandy loam, 1 to 5 percent slopes (where irrigated)
WhC Windthorst fine sandy loam, 1 to 5 percent slopes
WnB Winters loam, 1 to 3 percent slopes

Rangeland

Reggie Quiett, Range Conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland is land on which the vegetation consists mainly of native grasses, grasslike plants, forbs, shrubs, and trees. The plants are generally suitable for grazing, and growth is sufficient to be used for grazing. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition of the plant community for forage production is determined by the soil, climate, topography, overstory vegetation, and grazing management.

In 1998, about 525,729 acres, or 89.2 percent of Jack County, was rangeland that supported mainly beef cattle. The numbers of sheep and goats have diminished greatly because of predators. Few horses raised in the county are used for ranch work. Most are used for recreation.

Figure 11.—An area of Truce fine sandy loam, 1 to 5 percent slopes. Brush management is needed to prevent brush from reestablishing on several soils in the county, including this Truce soil.

Most ranches are cow-calf operations. Some of the operations are supplemented with winter stockers. This practice provides greater flexibility for adjusting the number of livestock during periods of drought. Most ranches include some acreage for crops or improved pasture. The supplemental forage is either grazed or harvested for hay. The main forage crops are small grains and forage sorghum. Improved pastures consist of improved bermudagrass, kleingrass, and weeping lovegrass.

Native rangeland has been heavily grazed for several generations. Originally, the county produced a wide variety of tall and mid grasses interspersed among an abundance of forbs. Much of the rangeland is now covered by short and mid grasses, forbs, and juniper, mesquite, and oak trees.

About 75 percent of the annual forage growth takes place in March, April, May, and June, when spring rains and moderate temperatures are favorable for warm-season plants. A second growth period occurs in September and October, when fall rains and gradually cooling temperatures are common.

Droughts of varying duration are common. Short periods of drought normally occur each year. Longer periods, lasting for several months, occur less frequently.

The major concern in managing most rangeland is controlling grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Proper stocking rates and a deferred grazing system are good practices. Controlling brush by mechanical, chemical, or biological means is also important (fig. 11).

Seeding native and introduced grasses in areas of inadequate vegetation prevents excessive erosion and furnishes desirable forage. Good management that is

based on soil survey information and rangeland inventories increases the potential productivity of rangeland in the county.

A range site is a distinctive kind of rangeland. It produces a characteristic natural plant community that differs from those on other range sites in kind, amount, and proportion of range plants. The natural plant community on the range site is also referred to as the climax plant community or climax vegetation because it represents the culmination of the effects of all the factors of the natural environment.

Climax vegetation is the stabilized plant community that reproduces itself and changes very little so long as the environment remains unchanged. It consists of the plants that grew on the site before the survey area was first settled. The most productive combination of native forage plants on a range site is generally the climax vegetation.

Range sites are subject to many influences that modify or even temporarily destroy vegetation. Examples are drought, overgrazing, wildfires, and short-term tillage. If the changes are not too severe, the plant community can recover and return to climax condition. Severe deterioration, however, may permanently alter the potential of the range site.

Grazing can change the quality and quantity of forage on a range site by changing the proportion of decreaser, increaser, and invader plants in the composition of the plant community.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreasers are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that are normally not included in the climax plant community because they cannot compete with the climax vegetation for moisture, nutrients, and light. They invade the site and grow along with increasers only after the amount of climax vegetation has been reduced by continual heavy grazing. Most invader species have little grazing value.

Rangeland management requires a knowledge of the kinds of soil and of the climax or potential natural plant community on a particular range site. The current range condition is assessed and compared to the climax plant community. The more closely the existing community resembles the climax community, the better the range condition. Range condition is an ecological rating only and does not have specific meaning relating to the existing plant community in a given use.

Four range condition classes are used to show the degree of departure from the potential or climax vegetation. A range site is in excellent condition if 76 to 100 percent of the present plant community is the same as the climax vegetation, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season. In areas that have similar climate and topography, differences in the kind and amount of vegetation produced are closely related to the kind of soil. Effective management is based on the relationship among soils, vegetation, and water.

Table 6 shows for each soil the *range site* and the *potential annual production* of vegetation in favorable, average, and unfavorable years. An explanation of the column headings in the table follows.

A *range site* is listed for each map unit in the table. Soils vary in their capability to produce grasses and other plants suitable for grazing. Soils that produce about the same kinds and amounts of forage are grouped into a range site.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of

vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Nineteen range sites are in the survey area—Bouldery Hill, Clay Flat, Clay Loam, Clay Loam Slope, Clayey Bottomland, Clayey Upland, Claypan Prairie, Loamy Bottomland, Loamy Prairie, Loamy Sand, Low Stony Hill, Redland, Rocky Hill, Sandstone Hill, Sandy Loam, Shallow, Shallow Clay, Steep Rocky, and Tight Sandy Loam. The following descriptions give for each site the climax community and changes to be expected if the site is overgrazed.

Bouldery Hill range site. Shatruce soils are in this range site. The climax vegetation consists mainly of little bluestem. Vegetative density varies according to the number and size of boulders. The size and density of trees vary according to soil depth and the number of boulders. Trees are frequently small and in shallow soil. The composition, by weight, is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Little bluestem makes up almost half of the climax vegetation. Indiangrass, sideoats grama, and other perennial grasses, such as silver bluestem, Scribner panicum, purpletop tridens, tall dropseed, switchgrass, hooded windmillgrass, Wright threeawn, and hairy grama, occur in smaller amounts. Woody plants include post oak and skunkbush sumac. Blackjack oak, Texas ash, greenbrier, honeysuckle, elbowbush, elm, bumelia, and prickly ash are present in smaller amounts when the site is in climax condition. Forbs consist of croton, prairie clovers, western ragweed, Engelmann daisy, bundleflower, and lespedeza.

If regression occurs as a result of heavy grazing, little bluestem and indiangrass are replaced by sideoats grama, dropseed, hooded windmillgrass, and silver bluestem. Continued heavy grazing results in a proliferation of threeawn, low panicum, red lovegrass, and weeds. Skunkbush sumac, mesquite, pricklypear, and, in some cases, post oak increase in abundance.

Clay Flat range site. Treadway soils are in this range site. The climax plant community is made up of short and mid grasses. The composition, by weight, is about 90 percent grasses and 10 percent forbs. Woody plants are present in very small amounts.

The climax vegetation consists mainly of buffalograss. Vine mesquite, white tridens, alkali sacaton, and blue grama occur in small amounts along with smaller amounts of Texas wintergrass, silver bluestem, western wheatgrass, threeawn, tall dropseed, and meadow dropseed. Forbs consist of Illinois bundleflower, trailing ratany, heath aster, Dakota verbena, greenthread, curlycup gumweed, skullcap, primrose, blue-eyed-grass, and catclaw sensitivebrier. The woody plants are mainly lotebush.

If regression occurs as a result of heavy grazing, mid grasses decrease in abundance and buffalograss takes over. Annual grasses occur in larger numbers and threeawn increases in abundance as heavy grazing continues. With continued heavy use, mesquite and pricklypear invade and lotebush increases somewhat in abundance.

Clay Loam range site. Rowden, Winters, and Wise soils are in this range site. The climax plant community is an open prairie of mid grasses. The composition, by weight, is about 90 percent grasses, 10 percent forbs, and very small amounts of woody plants.

The climax vegetation consists mainly of sideoats grama and vine mesquite. Silver bluestem, buffalograss, wintergrass, Texas cupgrass, white tridens, and meadow dropseed occur in small amounts. Canada wildrye, blue grama, western wheatgrass, and Arizona cottontop occur in smaller amounts. Forbs consist of yellow neptunia, sensitivebrier, Engelmann daisy, curlycup gumweed, trailing ratany, bundleflower, heath aster, Maximilian sunflower, pitcher sage, and dalea. Woody plants include ephedra, elm, and hackberry.

If regression occurs as a result of heavy grazing, sideoats grama, vine mesquite, and silver bluestem are replaced by buffalograss and Texas wintergrass. Continued heavy grazing results in a plant community of threeawn, Texas grama, western ragweed, lotebush, mesquite, pricklypear, and annual grasses.

Clay Loam Slope range site. Set soils are in this range site. The climax plant community is an oak and ash savannah with an understory of tall and mid grasses. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little bluestem. Sideoats grama, big bluestem, vine mesquite, and indiangrass occur in small amounts. Silver bluestem, Texas wintergrass, tall dropseed, meadow dropseed, Canada wildrye, low panicums, Texas bluegrass, threeawn, white tridens, and gummy lovegrass occur in smaller amounts, and there is a trace amount of switchgrass. The woody plants consist mainly of live oak, Texas oak, Texas ash, and cedar elm. Also present are juniper, hackberry, sumac, bumelia, elbowbush, greenbrier, shin oak, and yucca. Forbs include Maximilian sunflower, western ragweed, heath aster, bundleflower, verbena, wildbean, guara, sensitivebrier, gray goldaster, sagewort, and trailing ratany.

If regression occurs as a result of heavy grazing,

big bluestem, indiangrass, switchgrass, and most perennial forbs decrease in abundance. Plants such as little bluestem, sideoats grama, vine mesquite, silver bluestem, and Texas wintergrass increase in abundance. Continued heavy grazing results in a plant community of hairy tridens, Scribner panicum, hairy grama, annual lovegrass, hooded windmillgrass, Texas grama, buffalograss, gray goldaster, milkweeds, nightshade, greenbrier, elbowbush, pricklypear, tasajillo, buckeye, lotebush, catclaw, whitebrush, juniper, mesquite, and shin oak.

Clayey Bottomland range site. Westfork soils are in this range site. The climax plant community is a savannah with a tree canopy making up about 15 percent. The understory consists of tall and mid grasses, several shrubs, woody vines, sedges, and forbs. The composition, by weight, is about 85 percent grasses, 10 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama, vine mesquite, and blue grama. Indiangrass and little bluestem occur in small amounts. Wildryes, western wheatgrass, Arizona cottontop, buffalograss, white tridens, Scribner panicum, Texas wintergrass, and silver bluestem occur in smaller amounts. Woody plants include elm, post oak, live oak, bur oak, and hackberry and small amounts of ash, pecan, cottonwood, willow, soapberry, bumelia, and greenbrier. Forbs include Maximilian sunflower, bundleflower, sensitivebrier, partridge pea, and lespedeza and very small amounts of heath aster, western ragweed, and ironweed.

If regression occurs as a result of heavy grazing, sideoats grama, vine mesquite, silver bluestem, blue grama, western wheatgrass, wildryes, and palatable forbs decrease in abundance. Texas wintergrass, Arizona cottontop, buffalograss, white tridens, and Scribner panicum increase in abundance initially. Continued heavy grazing results in a plant community dominated by buffalograss and invader plants such as threeawn and annual cool-season grasses. Other invaders, such as mesquite, lotebush, tasajillo, and pricklypear, also appear.

Clayey Upland range site. Leeray soils are in this range site. The climax plant community is an open, mid-grass prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama, vine mesquite, and Texas wintergrass. Western wheatgrass, Texas bluegrass, and buffalograss occur in small amounts. Curly mesquite, white tridens, silver bluestem, Arizona cottontop, white tridens, tall dropseed, meadow dropseed, Texas cupgrass, Japanese brome, and Texas grama occur in smaller amounts. Woody plants include hackberry, ephedra, lotebush, and bumelia. Forbs consist of sensitivebrier, heath aster, western ragweed, Engelmann daisy, slender greenthread, dotted gayfeather, and guara.

If regression occurs as a result of heavy grazing, vine mesquite, white tridens, sideoats grama, and Arizona cottontop begin to disappear. Silver bluestem, buffalograss, curly mesquite, and Texas wintergrass increase in abundance. Continued heavy grazing results in a plant community of condalia, mesquite, pricklypear, threeawn, and broomweed.

Claypan Prairie range site. Hassee, Kamay, and Thurber soils are in this range site. The climax plant community is an open, mid- and short-grass prairie. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama, blue grama, Arizona cottontop, and vine mesquite and small amounts of silver bluestem, buffalograss, Texas wintergrass, and tall dropseed. Western wheatgrass, threeawn, sand dropseed, white tridens, and meadow dropseed occur in smaller amounts. Woody plants consist of sagewort, heath aster, bushsunflower, dotted gayfeather, Engelmann daisy, western ragweed, sensitivebrier, verbena, bundleflower, Maximilian sunflower, and trailing ratany.

If regression occurs as a result of heavy grazing, sideoats grama, vine mesquite, blue grama, and Arizona cottontop decrease in abundance. Silver bluestem, buffalograss, Texas wintergrass, tall dropseed, threeawn, and sand dropseed increase in abundance. Continued heavy grazing results in a proliferation of mesquite, pricklypear, annual grasses, hairy tridens, and tumble lovegrass. Condalia also increases in abundance as the plant community deteriorates.

Loamy Bottomland range site. Bosque, Gowen, and Pulexas soils are in this range site. This site consists of tall grasses and smaller amounts of mid grasses. Trees, vines, and scattered browse plants are typical. Flooding and an occasional high water table increase the vegetative growth potential. The composition, by weight, is about 75 percent grasses, 15 percent woody plants, and 10 percent forbs.

The climax vegetation consists mainly of switchgrass, indiangrass, big bluestem, and little bluestem and small amounts of sideoats grama and vine mesquite. Other perennial grasses, such as Arizona cottontop, Canada wildrye, western wheatgrass, Texas wintergrass, buffalograss, silver bluestem, meadow dropseed, and white tridens, also occur in smaller amounts. Woody plants include elm,

pecan, hackberry, and small amounts of greenbrier, bumelia, wolfberry, skunkbush sumac, elbowbush, and ephedra. Forbs consist of Engelmann daisy, Maximilian sunflower, heath aster, trailing ratany, bushsunflower, guara, sagewort, bundleflower, and western ragweed.

If regression occurs as a result of heavy grazing, the tall and mid grasses decrease in abundance and buffalograss, silver bluestem, and Texas wintergrass increase in abundance initially. Continued heavy grazing results in increased amounts of annual grasses and forbs, mesquite, pricklypear, lotebush, wolfberry, and ragweed.

Loamy Prairie range site. Anocon soils are in this range site. The climax plant community is a treeless, mid- and tall-grass prairie. The composition, by weight, is about 90 percent grasses, 10 percent forbs, and very small amounts of woody plants.

The climax vegetation consists mainly of little bluestem, big bluestem, and indiangrass. Switchgrass, sideoats grama, blue grama, meadow dropseed, and other perennial grasses, such as Texas wintergrass, buffalograss, silver bluestem, vine mesquite, and white tridens, occur in smaller amounts. Forbs consist of Engelmann daisy, Baldwin ironweed, bundleflower, white prairie clover, yellow neptunia, and pinkscale gayfeather.

If regression occurs as a result of heavy grazing, meadow dropseed, Texas wintergrass, and buffalograss increase in abundance. Continued heavy grazing results in a plant community of buffalograss, Texas wintergrass, oldfield threeawn, Texas grama, American basketflower, western ragweed, curlycup gumweed, Japanese brome, and mesquite.

Loamy Sand range site. Chaney and Selden soils are in this range site. The climax plant community is made up of tall and mid grasses growing on an open savannah along with scattered stands of post oak and blackjack oak. The composition, by weight, is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little bluestem, big bluestem, and indiangrass and small amounts of sand lovegrass, Texas bluegrass, purpletop tridens, silver bluestem, sand dropseed, tall dropseed, and sideoats grama. Texas wintergrass, Canada wildrye, Scribner panicum, switchgrass, and plains lovegrass occur in smaller amounts. Woody plants consist mainly of post oak and blackjack oak and smaller amounts of greenbrier, bumelia, sumacs, prickly ash, hackberry, and shin oak. Forbs include Engelmann daisy, Maximilian sunflower, sagewort, western ragweed, gayfeather, dalea, yellow neptunia, sensitivebrier, trailing wildbean, primrose, partridge pea, guara, and buckwheat.

If retrogression occurs as a result of heavy grazing, little bluestem, big bluestem, indiangrass, sand lovegrass, and the more palatable forbs decrease in abundance. Silver bluestem, tall dropseed, sand dropseed, Texas wintergrass, and woody plants increase in abundance. Continued heavy grazing results in an increase of fall witchgrass, hooded windmillgrass, red lovegrass, tumble lovegrass, gummy lovegrass, tumblegrass, and threeawn. Woody plants, such as blackjack oak, post oak, greenbrier, shin oak, mesquite, juniper, and catclaw, also increase in abundance.

Low Stony Hill range site. Palopinto soils are in this range site. The plant community consists of a live oak savannah that is less than 20 percent tree canopy and that is dominated by little bluestem. The composition, by weight, is about 85 percent grasses, 10 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little bluestem and smaller amounts of indiangrass and big bluestem. Sideoats grama, tall dropseed, silver bluestem, vine mesquite, Texas wintergrass, wildryes, and other perennial grasses, such as green sprangletop, Texas cupgrass, plains lovegrass, threeawn, buffalograss, fall witchgrass, and hairy grama, also occur in smaller amounts. Woody plants consist of live oak, elm, hackberry, and very small amounts of sumacs, bumelia, elbowbush, black dalea, shin oak, and greenbrier. Forbs include Maximilian sunflower, bushsunflower, Engelmann daisy, blacksamson, penstemon, gayfeather, bundleflower, sensitivebrier, yellow neptunia, dalea, prairie clover, scurfpea, western indigo, and western ragweed.

If regression occurs as a result of heavy grazing, big bluestem, little bluestem, indiangrass, green sprangletop, Canada wildrye, and palatable forbs decrease in abundance. Sideoats grama, Texas wintergrass, and buffalograss increase in abundance initially. Continued heavy grazing results in a plant community of buffalograss, Texas wintergrass, hairy tridens, Texas grama, tumblegrass, annual bromes, mesquite, pricklypear, agarito, and ashe juniper.

Redland range site. Hensley soils are in this range site. The climax plant community is an oak savannah. The overstory shades about 20 percent of the site and consists primarily of live oak and post oak, although Bigelow oak or Texas oak can be present. Little bluestem dominates the understory. The composition, by weight, is about 85 percent grasses, 10 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little

bluestem, indiangrass, and big bluestem and small amounts of sideoats grama, tall dropseed, silver bluestem, Texas wintergrass, and vine mesquite. Wildryes, plains lovegrass, Texas cupgrass, buffalograss, curly mesquite, Wright threeawn, fall witchgrass, and purpletop tridens occur in smaller amounts. Woody plants include live oak, post oak, Bigelow oak, Texas oak, and very small amounts of elm, hackberry, redbud, bumelia, sumacs, elbowbush, catclaw mimosa, agarito, greenbrier, ephedra, and honeysuckle. Forbs consist of Maximilian sunflower, bushsunflower, Engelmann daisy, gayfeather, blacksamson, sagewort, pitcher sage, halfshrub sundrop, bundleflower, sensitivebrier, daleas, and several other forbs.

If regression occurs as a result of heavy grazing, big bluestem, little bluestem, indiangrass, and wildryes decrease in abundance. Sideoats grama, tall dropseed, silver bluestem, Texas wintergrass, and buffalograss increase in abundance. Continued heavy grazing results in a plant community of Texas wintergrass, curly mesquite, buffalograss, and woody plants.

Rocky Hill range site. Owens soils are in this range site. The climax plant community is mid and short grasses and an open savannah of scattered woody plants. The composition, by weight, is about 85 percent grasses, 10 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama, silver bluestem, and buffalograss. White tridens, vine mesquite, curly mesquite, Texas wintergrass, Arizona cottontop, tall dropseed, hairy grama, rough tridens, threeawn, and Texas cupgrass occur in smaller amounts, and there is also a very small amount of little bluestem. Woody plants consist of live oak, hackberry, elm, ephedra, agarito, catclaw, elbowbush, sumac, yucca, bumelia, and lotebush. Forbs include western ragweed, sagewort, heath aster, bundleflower, trailing ratany, buckwheats, daleas, and gray goldaster.

If regression occurs as a result of heavy grazing, sideoats grama, vine mesquite, and silver bluestem are replaced by buffalograss and curly mesquite. Continued heavy grazing results in a plant community of buffalograss, curly mesquite, rough tridens, hairy grama, and Texas grama along with mesquite, lotebush, whitebrush, juniper, pricklypear, and tasajillo.

Sandstone Hill range site. Cona, Exray, Darnell, Jacksboro, and Shatruce soils are in this range site. The climax vegetation consists of an open stand of mostly post oak trees and an understory of mid and tall grasses. Little bluestem dominates the site in climax condition. The composition, by weight, is about 75 percent grasses, 15 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little bluestem and small amounts of indiangrass, big bluestem, switchgrass, sand lovegrass, sideoats grama, and Scribner panicum. Small amounts of other perennial grasses, such as purpletop tridens, silver bluestem, hairy grama, tall dropseed, Texas wintergrass, and hooded windmillgrass, can also occur. Woody plants are mainly post oak and blackjack oak. Elm, Texas ash, greenbrier, skunkbush sumac, honeysuckle, elbowbush, bumelia, and prickly ash are present in smaller amounts. Forbs consist of western ragweed, Engelmann daisy, bundleflower, prairie clover, and lespedeza.

If regression occurs as a result of heavy grazing, big bluestem, indiangrass, switchgrass, and sand lovegrass decrease in abundance. Little bluestem, sideoats grama, silver bluestem, hairy grama, and skunkbush sumac increase in abundance. Continued heavy grazing results in a rapid increase of invaders, such as threeawn, red lovegrass, and sand dropseed, and annual grasses and forbs, such as ragweed and silverleaf nightshade. Post oak increases in abundance with regression of grasses along with elm, greenbrier, mesquite, and juniper.

Sandy Loam range site. Bastsil, Bonti, Duffau, Minwells, Stephenville, and Windthorst soils are in this range site. The climax plant community consists of a savannah of post oak and blackjack oak. The understory is dominated by mid and tall grasses. Greenbrier and other shrubs and vines comprise a minor, although significant, part of the vegetation. The composition, by weight, is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of little bluestem and small amounts of indiangrass, switchgrass, purpletop tridens, sand lovegrass, Canada wildrye, big bluestem, and Texas bluegrass. Tall dropseed, sideoats grama, paspalums, buffalograss, silver bluestem, and sedges occur in smaller amounts. Woody plants include post oak and blackjack oak and small amounts of bumelia and skunkbush sumac. Forbs consist of yellow neptunia, prairie clover, Engelmann daisy, bundleflower, Maximilian sunflower, and sensitivebrier.

If regression occurs as a result of heavy grazing, post oak and blackjack oak often form a dense canopy and low-growing woody plants increase in abundance. The resulting shady conditions reduce the production of climax grasses. Common invaders are threeawn, fall witchgrass, Hall panicum, tumble windmillgrass,

gummy lovegrass, curlycup gumweed, tumblegrass, sand dropseed, western ragweed, elm, flameleaf sumac, and mesquite.

Shallow range site. Aledo soils are in this range site. The climax plant community consists of a prairie of tall and mid grasses and many forbs. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

The climax vegetation consists mainly of little bluestem and lesser amounts of indiangrass, big bluestem, switchgrass, sideoats grama, and tall dropseed. Other perennial grasses also occur in small amounts. Forbs include Engelmann daisy, guara, Maximilian sunflower, blacksamson, compassplant, heath aster, halfshrub sundrop, and native legumes.

If regression occurs as a result of heavy grazing, big bluestem decreases in abundance, followed by indiangrass and switchgrass. Little bluestem, sideoats grama, and tall dropseed increase in abundance. Continued heavy grazing results in a plant community of Texas grama, hairy tridens, tumblegrass, red threeawn, Hall panicum, curlycup gumweed, queensdelight, milkweed, nightshade, ragweed, gray goldaster, chalkhill wooly-white, mesquite, pricklypear, and yucca.

Shallow Clay range site. Vernon soils are in this range site. The climax plant community consists of short grasses and scattered mid grasses. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama and lesser amounts of silver bluestem, buffalograss, vine mesquite, curly mesquite, Texas wintergrass, Arizona cottontop, meadow dropseed, hairy grama, and rough tridens. Very small amounts of threeawn and green sprangletop are also present. Woody plants include ephedra, wolfberry, dalea, catclaw, hackberry, and agarito. Forbs consist of western ragweed, sagewort, bundleflower, Engelmann daisy, and several annuals.

If regression occurs as a result of heavy grazing, sideoats grama, vine mesquite, and silver bluestem decrease in abundance and buffalograss and curly mesquite increase. Continued heavy grazing results in a plant community of buffalograss, curly mesquite, threeawn, mesquite, condalia, pricklypear, and annual grasses.

Steep Rocky range site. Palopinto soils are in this range site. The climax plant community consists mainly of a savannah of tall and mid grasses and live oak that is dominated by little bluestem. The composition, by weight, is about 75 percent grasses, 15 percent woody plants, and 10 percent forbs.

The climax vegetation consists mainly of little bluestem and smaller amounts of indiangrass, big bluestem, sideoats grama, tall dropseed, silver bluestem, vine mesquite, Texas wintergrass, and Canada wildrye and other perennial grasses, such as Texas cupgrass, plains lovegrass, threeawn, and buffalograss. Woody plants include live oak, cedar elm, Texas oak, hackberry, sumacs, bumelia, elbowbush, shin oak, and greenbrier. Forbs consist of Maximilian sunflower, bushsunflower, gayfeather, bundleflower, sensitivebrier, yellow neptunia, dalea, prairie clover, and scurfpea.

If regression occurs as a result of heavy grazing, big bluestem, indiangrass, little bluestem, Canada wildrye, and palatable forbs decrease in abundance and sideoats grama, silver bluestem, Texas wintergrass, and buffalograss increase. Continued heavy grazing results in a plant community of buffalograss, Texas wintergrass, hairy tridens, Texas grama, tumblegrass, red threeawn, ashe juniper, agarito, mesquite, pricklypear, tasajillo, prairie coneflower, nightshade, and other annual grasses and forbs.

Tight Sandy Loam range site. Bluegrove, Keeter, and Truce soils are in this range site. The climax plant community consists of a savannah of scattered post oak with a mid-grass understory. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

The climax vegetation consists mainly of sideoats grama and smaller amounts of Arizona cottontop, vine mesquite, blue grama, silver bluestem, buffalograss, Texas wintergrass, little bluestem, sand dropseed, and perennial threeawn. Woody plants include post oak, prickly ash, lotebush, skunkbush, sumac, greenbrier, bumelia, and agarito. Forbs consist of western ragweed, sagewort, sensitivebrier, trailing ratany, Engelmann daisy, dotted gayfeather, heath aster, guara, and verbena.

If regression occurs as a result of heavy grazing, sideoats grama, Arizona cottontop, and blue grama decrease in abundance. Buffalograss, hooded windmillgrass, and Texas wintergrass increase in abundance. Continued heavy grazing results in a plant community of buffalograss, hairy tridens, curly mesquite, Texas grama, threeawns, and mesquite.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in

evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Richard M. Prather, Biologist, Natural Resources Conservation Service, and Jim Lionberger, Wildlife Technician, Texas Parks and Wildlife Department, helped prepare this section.

The abundance and diversity of animal life in Jack County stems from the quality, quantity, and diversity of wildlife habitat. White-tailed deer, Rio Grande turkey, bobwhite quail, mourning dove, cottontail rabbit, California jackrabbit, and fox squirrel are common. Numerous kinds of waterfowl feed and rest in the survey area during their annual migrations. Nongame species are abundant, and armadillo, opossum, red fox, gray fox, raccoon, skunk, and several kinds of bats, small rodents, raptors, and songbirds inhabit areas throughout the county. There are also several predators, such as bobcat and coyote, as well as reptiles and amphibians.

According to the Texas Parks and Wildlife Department, Jack County has five vegetative areas. These areas provide different kinds of habitat for wildlife. The areas are Live Oak-Mesquite-Ashe Juniper Parks; Mesquite-Lotebush Shrub; Post Oak Park/Woods; Post Oak Woods, Forest, and Grassland Mosaic; and Crops.

The Live Oak-Mesquite-Ashe Juniper Parks vegetative area covers most of the county. The soils most likely to occur in this area are Anocon, Bluegrove, Bosque, Exray, Darnell, Hassee, Hensley, Leeray, Palopinto, Rowden, Set, Palopinto, Thurber, and Winters.

This vegetative area provides good habitat for deer, turkeys, and quail. Mesquite, post oak, cedar elm, and some shin oak provide cover and mast. Flameleaf sumac, saw greenbrier, sunflower, Maximilian sunflower, and hairy vetch as well as other forbs and legumes provide leafy plants for deer and turkeys and seeds for quail. Pecan, hackberry, willow, cedar elm,

Figure 12.—An area of Thurber clay loam, 0 to 2 percent slopes, in the foreground, and an area of Shatruce gravelly fine sandy loam, 8 to 30 percent slopes, very stony, in the background. Wildlife is abundant in these areas.

and post oak along the Trinity River bottom and other drainageways provide very good habitat for turkeys and deer. Winter wheat, oats, and milo are the major grain crops grown in this vegetative area. The grain crops, along with sunflower and Maximilian sunflower, attract mourning doves.

The Mesquite-Lotebush Shrub vegetative area is in the extreme northern part of Jack County and covers part of the Bluegrove-Kamay general soil map unit. The soils most likely to occur are Anocon, Bluegrove, Kamay, Truce, and Treadway.

Mesquite is dominant in this vegetative area. Lotebush and tasajillo provide higher quality resting and escape cover for quail than downed mesquite trees or mesquite trees that have low, broken limbs. The major grain crops in this area are winter wheat, oats, and milo. Various forbs and legumes provide food for quail and doves. Some deer and turkeys are present although they are not as plentiful as in other vegetative areas.

The Post Oaks Park/Woods vegetative area occurs throughout the county and is good wildlife habitat. It covers the Exray-Truce-Bonti, Shatruce, and Gowen-Westfork general soil map units. The soils most likely to occur on this site are Bastsil, Bonti, Cona, Exray, Darnell, Gowen, Hassee, Jacksboro, Minwells, Owens, Shatruce, Stephenville, Thurber, Truce, and Westfork (fig. 12).

The deer population in this vegetative area is estimated to be 1 deer to 25 to 30 acres. Post oak, mesquite, cedar elm, and blackjack oak provide cover, browse, and acorns. Pecan, hackberry, willow, post oak, and blackjack oak grow along the Trinity River bottom and other drainageways and provide very good habitat for deer and turkeys. Live oaks are scattered throughout this area. Sunflower, Maximilian sunflower, snow on the mountain, western ragweed, and other forbs make up the herbaceous vegetation. Winter wheat, oats, and milo are the major grain crops. This

vegetative area supports quail and attracts mourning doves.

The Post Oak Woods, Forest, and Grassland Mosaic vegetative area is in the southeastern corner of the county and covers the Duffau-Windthorst-Keeter general map unit. It has only a small acreage. The soils most likely to occur in this area are Aledo, Chaney, Duffau, Keeter, Selden, Vernon, Windthorst, and Wise. Although much of this area has been cleared, sufficient areas of dense woody cover provide good wildlife habitat.

Post oak and mesquite are the major woody plants on this site. Also present are blackjack oak and, to a lesser extent, live oak. Pecan, willow, and cottonwood trees grow along drainageways. Winter wheat and milo are the major grain crops. Forbs include sunflower, Maximilian sunflower, wild foxglove, and western ragweed. This site attracts mourning doves, turkeys, and quail. Although deer inhabit this area, they are not as plentiful as in other vegetative areas.

The Crops vegetative area is in the extreme west-central part of the county and covers the Bluegrove-Kamay general soil map unit. It has only a small acreage. The soils most likely to occur in this vegetative area are Anocon, Bluegrove, Kamay, Truce, and Treadway soils. This area is no longer heavily cropped. Mesquite has invaded many of the fields that were once cropped, or the fields are now in coastal bermudagrass. Small mammals, dove, quail, and songbirds are plentiful.

A source for winter food for wildlife is a concern in Jack County. Planting food plots or grain fields is very helpful. Planting winter wheat is especially helpful because deer, doves, and waterfowl benefit from the wheat's high content of protein. Dry summer months can be stressful for wildlife. Milo, which is used by all kinds of game, is a good grain crop for wildlife during this time of year.

Grasses, such as little bluestem, Texas wintergrass, sand dropseed, sideoats grama, threeawn, and hairy tridens are prevalent in much of the county. Practices such as using a rotational grazing system and patterned brush management benefit wildlife. Disking the soil stimulates the growth of forbs, especially along field borders where it enhances the edge habitat for wildlife such as quail.

The county has numerous ponds, many of which are stocked with largemouth bass, bluegill, redear sunfish, and channel catfish. Green sunfish, bullhead catfish, crappie, gar, longear sunfish, carp, and various kinds of minnows inhabit the West Fork of the Trinity River, associated streams, and unmanaged ponds. Soils well suited to pond construction are Thurber and Treadway soils.

The quality of water in ponds is greatly affected by the soils. Surface water in Jack County generally is of good quality and is well suited to recreational fish production. Maintaining adequate water depth and controlling aquatic weeds, however, can be concerns for managers of fish ponds.

Endangered wildlife known to winter or migrate through the county are the whooping crane and the American peregrine falcon. The black-footed ferret is the only endangered mammal inhabiting the county. Threatened wildlife are the Texas kangaroo rat, the bald eagle, and the Texas horned lizard. The Artic peregrine falcon also migrates through the county.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting the appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface

layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, kleingrass, plains bluestem, coastal bermudagrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mesquite, lotebush, plum, and skunkbush sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, doves, coyote, songbirds, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, nutria, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include quail, deer, coyote, meadowlark, and songbirds.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the

limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as

the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15

percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits)

indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind

and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, more than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is

caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, apparent, or artesian; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. “More than 6.0” indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Bedrock is described as hard or soft if it is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(7)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 16 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustalf (*Ust*, meaning dry, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Paleustalfs (*Pale*, meaning old, excessive development, plus *ustalf*, the suborder of the Alfisols that has a ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Udic* identifies one of the subgroups of the great group. An example is Udic Paleustalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, thermic Udic Paleustalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(9)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(7)* and in "Keys to Soil Taxonomy" *(8)*. Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Aledo Series

The Aledo series consists of shallow, well drained, loamy soils on uplands. These soils formed in interbedded limestones and marls. Slopes range from 1 to 3 percent. The Aledo soils are loamy-skeletal, carbonatic, thermic Lithic Calciustolls.

Typical pedon of Aledo clay loam, 1 to 3 percent slopes; in Bartons Chapel, from the intersection of

Farm Road 4 and Farm Road 2210, about 1.8 miles east on Farm Road 2210, about 3.1 miles south and east on a ranch road, 1,200 feet north of the ranch road, in rangeland:

A—0 to 6 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; common wormcasts and insect tunnels; about 10 percent limestone pebbles; 41 percent calcium carbonate equivalent; violently effervescent; moderately alkaline; clear smooth boundary.

Ak—6 to 15 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; common wormcasts and insect tunnels; about 40 percent limestone pebbles; common films and threads of calcium carbonate; many calcium carbonate coatings and deposits on underside of rock fragments; 55 percent calcium carbonate equivalent; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—15 to 35 inches; indurated limestone that is coarsely fractured at intervals of 4 to 10 inches; roots and soil material in fractures.

The thickness of the solum and the depth to hard, coarsely fractured limestone range from 9 to 20 inches. The content of limestone fragments ranges from 35 to 50 percent in the control section. The fragments are mostly less than 6 inches across the long axis, but a few larger fragments may occur. The calcium carbonate equivalent ranges from 40 to 80 percent throughout the solum.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. The content of limestone fragments ranges from 5 to 15 percent in the A horizon and from 35 to 50 percent in the Ak horizon.

The R horizon is coarsely fractured indurated limestone that is interbedded with layers of weakly cemented limestone and marl. The limestone fractures are more than 4 inches apart.

Anocon Series

The Anocon series consists of very deep, well drained, loamy soils on uplands. These soils formed in loamy and clayey material. Slopes range from 1 to 3 percent. The Anocon soils are fine, mixed, thermic Udic Argiustolls.

Typical pedon of Anocon loam, 1 to 3 percent slopes; from the courthouse in Jacksboro, 4.1 miles southeast on U.S. Highway 281, about 4.1 miles south on Farm Road 3324, about 1.1 miles east on a private ranch road, 100 feet north, in rangeland:

A—0 to 8 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; hard, friable; many fine roots; many fine pores; common wormcasts and worm channels; neutral; clear smooth boundary.

BA—8 to 14 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine roots; many fine pores; common wormcasts and channels; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt1—14 to 28 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; common medium faint yellowish red (5YR 4/6) mottles; moderate fine angular blocky structure; very hard, very firm, sticky and plastic; common fine roots; common fine pores; few wormcasts; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—28 to 36 inches; reddish yellow (5YR 6/6) clay, yellowish red (5YR 5/6) moist; common medium distinct dark reddish brown (5YR 3/4) and brown (10YR 5/3) and common fine distinct dark red (2.5YR 3/6) mottles; moderate fine angular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; few fine pores; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

Bt3—36 to 45 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; common medium distinct brown (10YR 4/3), dark red (2.5YR 3/6), and dark reddish brown (5YR 3/4) and common fine distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few fine pores; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

BCt—45 to 68 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; common medium distinct yellowish red (5YR 5/8) and very pale brown (10YR 7/3) mottles; weak fine subangular blocky structure; hard, firm; few very fine roots; few fine pores; few distinct clay films on faces of peds; about 13 percent siliceous pebbles; neutral; clear wavy boundary.

C—68 to 80 inches; interbedded shale, weakly cemented sandstone, and clay occurring in shades of red, yellow, or brown; slightly alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. It comprises the A and BA horizons and, in places, the Bt1 horizon.

The A horizon is brown, dark brown, or dark grayish brown. Reaction is slightly acid or neutral.

The BA horizon is brown, dark brown, or dark grayish brown. It is loam or clay loam. Reaction is slightly acid or neutral. Some pedons do not have a BA horizon.

The Bt horizon is reddish brown, brown, yellowish brown, or reddish yellow. Mottles are in shades of red, brown, or yellow and range from none to common and from faint to distinct. In some pedons, the lower part of the Bt horizon has mottles that are gray because they are remnants of the parent material and not because of wetness. The horizon is clay loam or sandy clay loam. The clay content of the control section averages 35 to 45 percent. Reaction ranges from slightly acid to slightly alkaline.

The BC horizon is reddish yellow or yellowish red or is mottled in shades of red, yellow, or brown. It is sandy clay loam or sandy clay. Sandstone pebbles are in most pedons and make up 0 to 15 percent of the horizon. Reaction is neutral to moderately alkaline. In some pedons, the horizon has few soft masses of calcium carbonate but the matrix is noncalcareous.

The C horizon is interbedded sandstone, shale, and loamy material in shades of red, yellow, brown, or gray. It ranges from 1 to 10 inches in thickness.

Bastsil Series

The Bastsil series consists of very deep, well drained, loamy, alluvial soils that formed in ancient loamy terrace alluvium. Slopes range from 1 to 5 percent. The Bastsil soils are fine-loamy, siliceous, thermic Udic Paleustalfs.

Typical pedon of Bastsil fine sandy loam, 1 to 5 percent slopes (fig. 13); from the courthouse in Jacksboro, 0.8 mile north and west on U.S. Highway 281, about 5.4 miles north on Farm Road 148, about 25 feet east, in rangeland:

A—0 to 6 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; common fine pores; common wormcasts; few rounded siliceous pebbles as much as 1 centimeter in diameter; slightly acid; clear smooth boundary.

E—6 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable; many fine and medium roots; common fine pores; few wormcasts; few rounded siliceous pebbles as much as 1 centimeter in diameter; slightly acid; clear smooth boundary.

Bt1—10 to 15 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; few fine faint mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; common fine pores; few wormcasts and channels; many distinct clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—15 to 30 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; common medium distinct strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—30 to 40 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common fine and medium distinct yellowish red (5YR 4/6 and 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; common fine pores; many insects, wormcasts, and channels; common distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt4—40 to 54 inches; strong brown (7.5YR 5/6) fine sandy loam, strong brown (7.5YR 4/6) moist; many coarse distinct reddish brown (5YR 4/4) and yellowish red (5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; light brownish gray (10YR 6/2) coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt/E1—54 to 66 inches; dark yellowish brown (10YR 4/6) fine sandy loam, dark yellowish brown (10YR 3/6) moist (Bt part); many coarse prominent dark brown (7.5YR 4/4) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, firm; light brownish gray (10YR 6/2) sand 1 to 3 millimeters thick between prisms (E part); few very fine roots; slightly acid; gradual smooth boundary.

Bt/E2—66 to 72 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/8) fine sandy loam, dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) moist (Bt part); moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, firm; light brownish gray (10YR 6/2) sand 1 to 3 millimeters thick between prisms (E part); few angular black

masses; few very fine roots; slightly acid; gradual smooth boundary.
Bt/E3—72 to 80 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/8) sandy clay loam, dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) moist (Bt part); moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, firm; light brownish gray (10YR 6/2) sand 2 to 7 millimeters thick between prisms (E part); few angular black masses; few very fine roots; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness. The content of clay within the control section is 20 to 30 percent.

The A horizon is reddish brown, light brown, or brown. Reaction is moderately acid or slightly acid.

The E horizon is brown, light brown, pale brown, reddish brown, light yellowish brown, or pink. It is loamy fine sand or fine sandy loam. Reaction is moderately acid or slightly acid.

The Bt horizon is dark brown, strong brown, brown, reddish brown, or yellowish red. It is clay loam or sandy clay loam. Reaction ranges from moderately acid to slightly alkaline.

The Bt part of the Bt/E horizon is yellowish brown, light yellowish brown, brownish yellow, or reddish yellow. The E part of the horizon is light brownish gray and yellowish brown. The Bt/E horizon ranges from slightly acid to slightly alkaline.

Bluegrove Series

The Bluegrove series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in weakly cemented sandstone. Slopes range from 1 to 3 percent. The Bluegrove soils are fine, mixed, thermic Typic Haplustalfs.

Typical pedon of Bluegrove loam, 1 to 3 percent slopes; east of Jermyn, from the intersection of Texas Highway 199 and Farm Road 1191, about 1.4 miles north on Farm Road 1191, about 300 feet west, in a field:

Ap—0 to 5 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine granular structure; hard, friable; common fine roots; common fine pores; neutral; clear smooth boundary.
Bt1—5 to 19 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate fine and medium angular blocky structure; very hard, very firm; common fine roots; common fine pores; many distinct clay films on faces of peds; neutral; gradual smooth boundary.
Bt2—19 to 28 inches; dark reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine angular blocky structure; very hard, very firm; common fine roots; common fine pores; common distinct clay films on faces of peds; common fine rounded black concretions; neutral; clear smooth boundary.
Cr—28 to 48 inches; yellow (10YR 7/8) weakly cemented sandstone that is interbedded with shale and clay that has shale structure, brownish yellow (10YR 6/8) moist.

The thickness of the solum and the depth to weakly cemented sandstone and shale that has clay texture range from 20 to 40 inches.

The A horizon is reddish brown, brown, or dark brown. Reaction ranges from moderately acid to neutral.

Some pedons have a BA horizon. This horizon is brown or strong brown. It is sandy clay loam or clay loam.

The Bt horizon is red, reddish brown, reddish yellow, or yellowish red. It is clay loam or clay. Reaction is slightly acid or neutral.

The Cr horizon is yellow, reddish yellow, brownish yellow, or very pale brown. It is weakly cemented sandstone that is typically interbedded with shale that has clay texture. The strata range from 1 to 6 inches in thickness.

Bonti Series

The Bonti series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in beds of sandstone. Slopes range from 1 to 3 percent. The Bonti soils are fine, mixed, thermic Ultic Paleustalfs.

Typical pedon of Bonti fine sandy loam, 1 to 3 percent slopes (fig. 14); in Bryson, 3.7 miles south on Farm Road 1191, about 0.2 mile east and 0.4 mile south on a county road, 15 feet east of the road, in rangeland:

A—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, friable; many fine and medium roots; common fine pores; about 1 percent sandstone pebbles; neutral; abrupt smooth boundary.
Bt1—8 to 22 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium angular blocky structure; very hard, firm; common fine and medium roots; common fine pores; common wormcasts; many distinct clay films on faces of

peds; about 1 percent sandstone pebbles; moderately acid; gradual smooth boundary.

Bt2—22 to 34 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; common medium distinct red (2.5YR 4/6) mottles; moderate medium angular blocky structure; very hard, firm, sticky and plastic; common fine roots; common fine pores; many distinct clay films on faces of peds; about 4 percent sandstone pebbles; moderately acid; abrupt smooth boundary.

R—34 to 54 inches; reddish yellow (7.5YR 6/6) and red (2.5YR 4/6) strongly cemented and coarsely fractured sandstone; reddish brown (5YR 4/4) clay flows along fracture planes; few very fine and fine roots along fractures.

The thickness of the solum and the depth to sandstone range from 20 to 40 inches. The content of sandstone fragments in the A horizon ranges from 0 to 10 percent. The fragments can be as much as 24 inches across the long axis.

The A horizon is brown, yellowish brown, dark grayish brown, dark brown, light yellowish brown, light brown, or reddish yellow. Reaction ranges from moderately acid to neutral.

The Bt horizon is red, yellowish red, reddish brown, or reddish yellow. It is clay, clay loam, or sandy clay. Reaction is strongly acid or moderately acid. Base saturation ranges from 50 to 75 percent. The content of sandstone fragments ranges from 0 to 10 percent. The fragments generally are less than 3 inches in diameter. The content of clay ranges from 35 to 45 percent. The Bt2 horizon commonly has dark red, reddish yellow, strong brown, or yellowish brown mottles.

The R horizon is yellowish red, reddish brown, reddish yellow, yellowish brown, brownish yellow, pale yellow, or yellow. It is strongly cemented sandstone that is interbedded with clay or shale that has clay texture. Some pedons are underlain by conglomerate sandstone. Some fractures have clay flows and very fine and fine roots.

Bosque Series

The Bosque series consists of very deep, well drained, loamy soils on flood plains. These soils formed in calcareous alluvial deposits. Slopes are 0 to 1 percent. The Bosque soils are fine-loamy, mixed, thermic Cumulic Haplustolls.

Typical pedon of Bosque clay loam, occasionally flooded; in Bartons Chapel, from the intersection of Farm Road 4 and Farm Road 2210, about 2.5 miles east on Farm Road 2210, about 0.4 mile north on a dirt road to an old farmstead, east through a wire gate between two fields, 400 feet in a drainageway:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; many fine roots; few fine pores; common wormcasts; about 2 percent very fine soft masses, films, and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

A2—13 to 30 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; many fine pores; common wormcasts; about 3 percent very fine soft masses, films, and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw—30 to 40 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, firm; few fine roots; common fine pores; few wormcasts; about 5 percent very fine soft masses, films, and threads of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Akb—40 to 47 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; extremely hard, very firm; few fine roots; few fine and medium pores; about 3 percent very fine soft masses, films, and threads of calcium carbonate; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bwb—47 to 80 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; few medium dark yellowish brown (10YR 4/4) mottles; massive; very hard, firm; about 5 percent very fine soft masses, films, and threads of calcium carbonate; strongly effervescent; moderately alkaline.

The control section is loam or clay loam. The content of clay ranges from 20 to 35 percent. Most pedons have films and threads of calcium carbonate throughout the profile. The calcium carbonate equivalent ranges from 5 to 15 percent.

The A horizon is dark grayish brown or dark brown. The content of films and threads of calcium carbonate ranges from 1 to 5 percent.

The B horizon is brown, dark grayish brown, or very dark brown. It is clay loam or clay. The content of films and threads of calcium carbonate ranges from 3 to 15 percent.

The Akb horizon is normally below a depth of 40

inches. Some pedons do not have this buried horizon. The horizon is dark grayish brown or dark brown. Texture is loam, clay loam, or clay. The content of films and threads of calcium carbonate ranges from 1 to 5 percent.

The Bwb horizon is light yellowish brown, light brownish gray, pale brown, brown, or yellowish brown. It is loam, clay loam, or clay. The content of films and threads of calcium carbonate ranges from 3 to 15 percent.

Chaney Series

The Chaney series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in loamy sediments. Slopes range from 1 to 5 percent. The Chaney soils are fine, mixed, thermic Aquic Paleustalfs.

Typical pedon of Chaney loamy fine sand, 1 to 5 percent slopes; from the courthouse in Jacksboro, 9.0 miles north on Texas Highway 59, about 3.3 miles east on Farm Road 1810 to Cundiff Cemetery, 0.1 mile north on a county road, 4.7 miles northeast on the county road, 800 feet south of the road, in pasture:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine subangular blocky structure; loose; common fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 17 inches; reddish brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; common medium prominent yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; very hard, firm; common fine roots; few fine pores; common distinct clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—17 to 26 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common medium distinct strong brown (7.5YR 4/6) and light gray (10YR 6/1) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; common distinct clay films on faces of peds; slightly acid; clear wavy boundary.

Bt3—26 to 37 inches; yellowish brown (10YR 5/4) sandy clay, dark yellowish brown (10YR 4/4) moist; many coarse distinct light yellowish brown (10YR 6/4) and light gray (10YR 6/1) mottles; moderate medium prismatic structure parting to weak fine and medium subangular blocky; very hard, firm; few fine roots; common thick pale brown clay flows on faces of prisms; neutral; gradual wavy boundary.

BC—37 to 50 inches; white (10YR 8/1) sandy clay loam, light gray (10YR 7/1) moist; few fine faint light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; hard, firm; few fine pebbles; common soft masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—50 to 80 inches; light gray (10YR 7/1) sandy clay loam that is interbedded with shaly and clayey materials, gray (10YR 6/1) moist; common medium distinct red (2.5YR 4/6) and brownish yellow (10YR 6/6) mottles; massive; very hard, firm; about 2 percent fine rounded concretions of calcium carbonate; noncalcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is dark grayish brown, brown, or light yellowish brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, red, dark red, yellowish red, yellow, reddish yellow, strong brown, yellowish brown, or brownish yellow. It is mottled throughout in various shades of reds, yellows, browns, or grays. Texture is sandy clay or clay. The content of clay ranges from 35 to 50 percent. Reaction ranges from moderately acid to neutral.

The BC horizon is white or light gray. It is sandy clay loam or sandy clay. Reaction ranges from moderately acid to moderately alkaline.

The C horizon is sandy clay loam, sandy clay, or clay. Reaction ranges from moderately acid to moderately alkaline. In some pedons, this horizon has few films, threads, or soft masses of calcium carbonate. Some pedons have weakly cemented, discontinuous sandstone layers.

Cona Series

The Cona series consists of well drained, loamy and stony soils on uplands. These soils are moderately deep over shale. Slopes range from 3 to 8 percent. The Cona soils are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Cona fine sandy loam, 3 to 8 percent slopes, stony; south of Newport, from the intersection of Texas Highway 59 and Farm Road 2127, about 7.0 miles east and south on Farm Road 2127, about 0.6 mile north on Farm Road 2127, about 75 feet east, in rangeland:

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2)

moist; weak very fine subangular blocky structure; slightly hard, friable; common fine and medium roots; common fine pores; about 4 percent stones and 8 percent cobbles of sandstone and conglomerate sandstone on the surface and many imbedded in the soil; neutral; clear smooth boundary.

E—3 to 7 inches; brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 4/3) moist; single grain; slightly hard, friable; common fine and medium roots; common fine pores; 16 percent rounded siliceous pebbles and about 3 percent stones; neutral; abrupt smooth boundary.

Bt1—7 to 26 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; common fine distinct strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; few fine pores; many distinct clay films on faces of peds; moderately acid; gradual wavy boundary.

Bt2—26 to 38 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine pores; many distinct clay films on faces of peds; moderately acid; gradual wavy boundary.

C—38 to 60 inches; yellowish brown (2.5Y 6/4) shale that has clay texture, light olive brown (2.5Y 5/4) moist; weak platy structure; slightly alkaline.

The solum ranges from 20 to 40 inches in thickness. The content of clay in the control section ranges from 35 to 45 percent. The combined thickness of the A and E horizons ranges from 3 to 10 inches.

The A horizon is brown, reddish brown, very pale brown, or dark grayish brown. The content of fragments of sandstone and conglomerate sandstone that are 10 to 24 inches across ranges from 1 to 5 percent. The content of siliceous and sandstone pebbles ranges from 5 to 15 percent. Reaction ranges from slightly acid to slightly alkaline.

The E horizon is light brown, brown, very pale brown, or pale brown. The content of siliceous and sandstone pebbles ranges from 15 to 30 percent. The content of sandstone and conglomerate sandstone cobbles and stones ranges from 0 to 10 percent. Reaction is slightly acid or neutral.

The Bt horizon is red, reddish yellow, or yellowish red. It is clay or sandy clay. The content of siliceous or sandstone pebbles, cobbles, and stones ranges from 0 to about 8 percent. Reaction is strongly acid or moderately acid.

The C horizon is olive yellow, yellow, light yellowish brown, or light brownish gray. In some pedons, it has strata of loamy material. Reaction ranges from moderately acid to slightly alkaline. The horizon has none or few calcium carbonate masses.

Darnell Series

The Darnell series consists of shallow, well drained and somewhat excessively drained, loamy and sandy soils on uplands. These soils formed in materials weathered from sandstone. Slopes range from 1 to 8 percent. The Darnell soils are loamy, siliceous, thermic, shallow Udic Haplustepts.

Typical pedon of Darnell fine sandy loam in an area of Exray-Darnell complex, 1 to 8 percent slopes, very stony (fig. 15); in Bryson, from the intersection of U.S. Highway 380 and Farm Road 1191, about 3.6 miles south on Farm Road 1191, about 0.8 mile east and south on a county road, 15 feet east, 50 feet north and 15 feet east from the corner of the intersection of two county roads, in rangeland:

A—0 to 4 inches; dark brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; soft, very friable; many fine and medium roots; few fine pores; about 2 percent sandstone pebbles; about 10 percent of surface covered with stones; slightly acid; clear smooth boundary.

Bw—4 to 15 inches; strong brown (7.5YR 5/6) fine sandy loam, strong brown (7.5YR 4/6) moist; weak fine subangular blocky structure; soft, very friable; common fine and medium roots; few fine pores; about 2 percent sandstone pebbles; moderately acid; clear wavy boundary.

Cr—15 to 35 inches; strong brown (7.5YR 5/8) cemented sandstone; cementation in upper 15 inches is moderate when dry and weak when moist, hardness increases as depth increases; slightly acid.

The solum ranges from 10 to 20 inches in thickness. The content of stones on the surface ranges from 5 to 15 percent.

The A horizon is brown, dark brown, or dark yellowish brown. It is fine sandy loam. The content of pebbles ranges from 0 to 10 percent. Reaction is neutral or slightly acid.

The Bw horizon is reddish brown, brown, strong brown, or yellowish brown. It is fine sandy loam. The content of pebbles ranges from 0 to 10 percent. Reaction ranges from moderately acid to neutral.

In some pedons, the Cr horizon is strongly cemented conglomerate. The sandstone is weakly cemented to moderately cemented above a depth of 20 inches when moist and becomes strongly cemented as depth increases. The strongly cemented

sandstone is interbedded with layers of clayey or shaly material that are 3 to 12 inches thick. These layers are 1 to more than 5 feet apart vertically.

Duffau Series

The Duffau series consists of very deep, well drained, loamy and sandy soils on uplands. These soils formed in loamy sediments or weakly cemented sandstone. Slopes range from 1 to 5 percent. The Duffau soils are fine-loamy, siliceous, thermic Udic Paleustalfs.

Typical pedon of Duffau very fine sandy loam, 1 to 5 percent slopes; in Westbrook, from the intersection of Texas Highway 199 and Farm Road 2210, about 2.7 miles south on Farm Road 2210, about 3.0 miles southeast on a county road, 10 feet east of the county road, in rangeland:

A—0 to 6 inches; brown (10YR 4/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine and few medium roots; common fine pores; neutral; clear smooth boundary.

E—6 to 15 inches; yellowish brown (10YR 5/4) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine and medium roots; few fine pores; slightly acid; abrupt smooth boundary.

Bt1—15 to 40 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common fine and few medium roots; common fine pores; many distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—40 to 58 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; moderate medium angular blocky structure; very hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt3—58 to 72 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common fine distinct red (2.5YR 4/8), yellowish red (5YR 5/6), and brown (7.5YR 5/4) mottles; moderate medium angular blocky structure; very hard, firm; common very fine roots; few fine and medium pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.

C—72 to 80 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common medium distinct and prominent red (2.5YR 5/8), and reddish yellow (5YR 6/8, 7.5YR 7/6) mottles; massive; neutral.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is yellowish brown, brown, or dark grayish brown. It is fine sandy loam or very fine sandy loam. Reaction is neutral or slightly alkaline.

The E horizon is pale brown, yellowish brown, brown, or brownish yellow. It is fine sandy loam or very fine sandy loam. Reaction ranges from slightly acid to slightly alkaline.

The Bt horizons are reddish brown, strong brown, yellowish red, reddish yellow, or red. The lower Bt horizons have none to common reddish brown, yellowish red, or strong brown mottles. The Bt horizons are sandy clay loam, loam, or clay loam. Reaction is slightly acid or neutral.

The C horizon is brownish yellow, yellow, or white. It is commonly stratified sandy clay loam, fine sandy loam, or weakly cemented sandstone. Reaction ranges from slightly acid to slightly alkaline. Some pedons do not have a C horizon.

Exray Series

The Exray series consists of shallow, well drained, loamy and stony soils on uplands. These soils formed in materials weathered from strongly cemented sandstone. Slopes range from 1 to 8 percent. The Exray soils are clayey, mixed, thermic Lithic Rhodustalfs.

Typical pedon of Exray fine sandy loam in an area of Exray-Darnell complex, 1 to 8 percent slopes, very stony (fig. 16); in Bryson, from the intersection of U.S. Highway 380 and Farm Road 1191, about 3.7 miles south on Farm Road 1191, about 0.5 mile east and south on a county road, 20 feet east of the road, in rangeland:

A—0 to 5 inches; brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 4/3) moist; weak very fine subangular blocky structure; soft, very friable; many fine and medium roots; many fine pores; about 10 percent sandstone stones on the surface and imbedded in the soil; neutral; abrupt smooth boundary.

Bt1—5 to 9 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; many fine and medium roots; many fine pores; many distinct clay films on faces of peds; about 3 percent sandstone cobbles and 1 percent sandstone

stones; few wormcasts; slightly acid; clear smooth boundary.
Bt2—9 to 17 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; many fine roots; many fine pores; many distinct clay films on faces of peds; few wormcasts; about 1 percent sandstone cobbles; slightly acid; abrupt smooth boundary.
R—17 to 37 inches; yellowish brown (7.5YR 8/2) strongly cemented coarsely fractured sandstone; fractures 1 to 10 feet apart extend deep into the horizon and are filled with reddish clayey material and roots.

The solum ranges from 10 to 20 inches in thickness. The content of stones on the surface ranges from 5 to 15 percent.

The A horizon is dark grayish brown, brown, or yellowish brown. The content of pebbles ranges from 0 to 10 percent. Reaction is slightly acid or neutral.

Some pedons have an E horizon. This horizon is light brownish gray, light yellowish brown, pale brown, or very pale brown. The content of pebbles ranges from 0 to 10 percent. Reaction is slightly acid or neutral. The combined thickness of the A and E horizons ranges from 4 to 10 inches.

The Bt horizon is dark red, red, reddish brown, reddish yellow, or yellowish red. It is clay loam, sandy clay, or clay. The content of pebbles ranges from 0 to 10 percent. The content of clay ranges from 35 to 50 percent. Reaction is moderately acid or slightly acid.

The R horizon is strongly cemented to indurated sandstone. Fractures are typically 6 to 20 inches apart. Most pedons have layers of clayey or shaly material 3 to 12 inches thick interbedded in the sandstone. These layers are 1 to more than 5 feet apart vertically. This horizon ranges from 5 to 50 feet in thickness.

Gowen Series

The Gowen series consists of very deep, well drained, loamy soils on flood plains. These soils formed in loamy alluvial materials. Slopes are 0 to 1 percent. The Gowen soils are fine-loamy, mixed, thermic Cumulic Haplustolls.

Typical pedon of Gowen loam, occasionally flooded (fig. 17); from the courthouse in Jacksboro, 2.5 miles south on U.S. Highway 281, about 3.5 miles east on U.S. Highway 380, about 5.4 miles north and east on a county road, 0.3 mile north and west on the county road, 500 feet north, in rangeland:

A1—0 to 28 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine and medium roots; neutral; gradual smooth boundary.
A2—28 to 41 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; common fine pores; thin lenses of clay loam; neutral; gradual smooth boundary.
Bk—41 to 80 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, firm; common threads and soft masses of calcium carbonate; few fine roots; strongly effervescent; moderately alkaline.

Surface horizons that have moist color values of less than 3.5 and evident structure range from 24 to about 60 inches in thickness. The clay content of the 10- to 40-inch control section averages 20 to 35 percent, and the content of material coarser than very fine sand is more than 15 percent. Reaction ranges from neutral to moderately alkaline.

The A horizon is very dark gray, dark gray, dark grayish brown, grayish brown, dark brown, or brown.

The B horizon is dominantly light yellowish brown, yellowish brown, dark yellowish brown, dark brown, brown, dark grayish brown, or very dark grayish brown. It is loam, clay loam, or sandy clay loam that has thin strata of fine sandy loam and clay. In some pedons, the lower part of the horizon has coarsely mottled layers.

Some pedons have a buried A horizon. This horizon is very dark grayish brown or dark brown.

Hassee Series

The Hassee series consists of very deep, moderately well drained, loamy upland soils. These soils formed in clayey calcareous sediments. Slopes are 0 to 1 percent. The Hassee soils are fine, smectitic, thermic Aquic Paleustalfs.

Typical pedon of Hassee loam, 0 to 1 percent slopes; from the courthouse in Jacksboro, 4.5 miles southeast on U.S. Highway 281, about 3.0 miles south on Farm Road 3324, about 40 feet east through a double gate, in rangeland:

A—0 to 8 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 3/2) moist; massive; very hard, friable; common fine roots; common fine pores; common wormcasts; neutral; clear wavy boundary.
E—8 to 14 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; very hard, friable; common fine roots;

common fine pores; common wormcasts; neutral; abrupt wavy boundary.
Bt—14 to 38 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; few fine faint brownish mottles; moderate fine angular blocky structure; very hard, very firm, sticky; common fine roots; common fine pores; many distinct clay films on faces of peds; common wormcasts; neutral; gradual smooth boundary.
Btk—38 to 60 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; very hard, very firm; common distinct clay films on faces of peds; common threads of calcium carbonate; slightly effervescent; slightly alkaline; gradual smooth boundary.
BCk—60 to 80 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm; few fine threads of calcium carbonate; slightly effervescent; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Concretions of calcium carbonate are below a depth of 30 inches. Most pedons contain few siliceous or ironstone pebbles.

The A horizon is grayish brown, dark grayish brown, or dark gray. It is massive and hard or very hard when dry. Reaction is slightly acid or neutral.

The E horizon is light gray or light brownish gray. It is loam or fine sandy loam. Reaction is slightly acid or neutral.

The Bt and Btk horizons are very dark grayish brown, dark grayish brown, gray, dark gray, or grayish brown. They are silty clay or clay. The content of clay ranges from 35 to 60 percent. Reaction is neutral or slightly alkaline. Effervescence ranges from none to strong.

The BCk horizon is grayish brown, brown, dark grayish brown, gray, or pale brown. It is clay or clay loam. Reaction is moderately alkaline. The horizon is slightly effervescent to strongly effervescent.

Hensley Series

The Hensley series consists of shallow, well drained, loamy soils on uplands. These soils formed over fractured, very hard limestone. Slopes range from 1 to 3 percent. The Hensley soils are clayey, mixed, thermic Lithic Rhodustalfs.

Typical pedon of Hensley loam, 1 to 3 percent slopes; from the courthouse in Jacksboro, 2.5 miles south on U.S. Highway 281, about 1.8 miles east on U.S. Highway 380, about 1.8 miles north on a county road, 100 feet east, in rangeland:

A—0 to 5 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common insect nests, tunnels, and wormcasts; slightly acid; clear smooth boundary.
Bt—5 to 15 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and plastic; common fine and medium roots; common fine pores; many distinct clay films on faces of peds; common insect nests and tunnels; neutral; abrupt wavy boundary.
R—15 to 35 inches; fractured indurated limestone containing soil material and roots in fractures.

The thickness of the solum and the depth to indurated limestone bedrock range from 10 to 20 inches. Limestone fragments that are 10 to 24 inches across and 1 to 10 inches thick cover as much as 40 percent of the surface. Limestone fragments within the soil range from 1 to 24 inches across and are 0.5 inch to 10.0 inches thick.

The A horizon is brown or reddish brown. The content of limestone fragments ranges to 30 percent. Reaction ranges from slightly acid to slightly alkaline. The horizon ranges from 4 to 10 inches in thickness.

The Bt horizon is reddish brown, weak red, or red. In some pedons, it has as much as 25 percent limestone fragments. Reaction is neutral or slightly alkaline.

The R horizon is hard fractured limestone that ranges from 5 to 100 feet in thickness.

Jacksboro Series

The Jacksboro series consists of shallow, well drained, loamy soils on uplands. These soils formed over indurated conglomerates and sandstones. Slopes range from 1 to 3 percent. The Jacksboro soils are clayey-skeletal, mixed, thermic Lithic Haplustalfs.

Typical pedon of Jacksboro fine sandy loam, 1 to 3 percent slopes; in Bryson, from the intersection of U.S. Highway 380 and Farm Road 1191, about 1.2 miles northwest, 1.2 miles north, 0.2 mile northeast on a county road, 100 feet east of a fence, in rangeland:

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; many fine and medium roots; 5 percent siliceous pebbles that are

less than 1 inch in diameter; slightly acid; clear smooth boundary.
E—4 to 11 inches; light brown (7.5YR 6/4) very gravelly fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; hard, friable; many fine and medium roots; 40 percent pebbles that are less than 1 inch in diameter; slightly acid; clear smooth boundary.
Bt—11 to 18 inches; red (10R 4/6) very gravelly clay, red (10R 4/6) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; many distinct clay films on faces of peds; 45 percent siliceous pebbles that are less than 2 inches in diameter; few siliceous cobbles; slightly acid; abrupt smooth boundary.
R—18 to 25 inches; indurated conglomerate sandstone.

The thickness of the solum and the depth to conglomerate sandstone range from 15 to 20 inches. The content of clay ranges from 35 to 45 percent.

The A horizon is dark brown, yellowish brown, dark yellowish brown, dark grayish brown, grayish brown, or brown. The content of rock fragments, mainly siliceous pebbles less than 3 inches in diameter, ranges from 2 to 14 percent. Reaction is slightly acid or neutral.

The E horizon is light brown, dark brown, yellowish brown, or dark yellowish brown. It is gravelly fine sandy loam or very gravelly fine sandy loam. The content of rock fragments, mainly siliceous pebbles and cobbles less than 6 inches in diameter, ranges from 15 to 60 percent. Reaction ranges from moderately acid to neutral.

The Bt horizon is reddish brown, yellowish red, or red. It is very gravelly clay loam or very gravelly clay. The content of rock fragments, mainly siliceous pebbles and cobbles less than 6 inches in diameter, ranges from 35 to 60 percent. Reaction ranges from strongly acid to slightly acid.

The R horizon is indurated conglomerate consisting of siliceous pebbles, cobbles, and sand cemented with silica, or it is indurated sandstone. These materials are interbedded with thin layers of shale or clay. The indurated layer ranges from 10 to 75 feet in thickness. The upper 10 feet of the indurated layer has fractures that are 4 to 60 feet apart.

Kamay Series

The Kamay series consists of very deep, well drained, loamy soils on uplands. These soils formed in clayey red beds. Slopes range from 1 to 3 percent. The Kamay soils are fine, smectitic, thermic Typic Paleustalfs.

Typical pedon of Kamay loam, 1 to 3 percent slopes; north of Antelope, from the intersection of Texas Highway Loop 187 and Farm Road 175, about 4.0 miles east on Farm Road 175, about 100 feet south, in cropland:

Ap—0 to 10 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; very hard, firm; common fine and few medium roots; few fine pores; neutral; abrupt smooth boundary.
Bt—10 to 18 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak primistic structure parting to moderate medium subangular blocky; very hard, very firm; common fine and few medium roots; many fine pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.
Btk1—18 to 43 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium angular blocky structure; very hard, firm; few fine roots; many fine pores; many distinct clay films on faces of peds; about 3 percent fine rounded calcium carbonate concretions; about 2 percent gypsum crystals; strongly effervescent; moderately alkaline; clear smooth boundary.
Btk2—43 to 68 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak medium angular blocky structure; very hard, firm; few fine roots; many fine pores; many distinct clay films on faces of peds; about 4 percent fine rounded calcium carbonate concretions; about 2 percent gypsum crystals; strongly effervescent; moderately alkaline; gradual smooth boundary.
C—68 to 85 inches; reddish brown (2.5YR 4/4) shale that has clay texture, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm; strongly effervescent; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The depth to films, threads, soft masses, or concretions of calcium carbonate ranges from 12 to 28 inches. The clay content of the control section ranges from 35 to 40 percent.

The A horizon is reddish brown, reddish gray, dark reddish gray, brown, dark brown, grayish brown, dark grayish brown, yellowish brown, or dark yellowish brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, reddish gray, dark reddish gray, brown, dark brown, grayish brown, dark grayish brown, yellowish brown, or dark yellowish brown. It is clay or clay loam. Reaction ranges from neutral to moderately alkaline.

The Btk horizon is light reddish brown, light red, reddish brown, red, reddish yellow, or yellowish red. It

is clay or clay loam. In some pedons, it has mottles in shades of red, brown, yellow, or gray. The content of calcium carbonate threads, masses, films, and concretions ranges from 3 to 10 percent. The content of gypsum crystals ranges from 0 to 5 percent. Reaction is slightly alkaline or moderately alkaline.

Some pedons have a BC horizon. This horizon is clay or clay loam in shades of red, brown, or yellow. In some pedons, it contains mottles in shades of red, brown, yellow, or gray. The content of calcium carbonate threads, masses, films, and concretions ranges from 3 to 10 percent. The content of gypsum crystals ranges from 0 to 5 percent. Reaction is slightly alkaline or moderately alkaline.

The C horizon is in shades of red or brown. In some pedons, it has mottles in shades of red, brown, or gray. The horizon is clay or shale that has clay texture and may be stratified with these materials. The content of calcium carbonate threads, masses, films, and concretions ranges from 3 to 10 percent. The content of gypsum crystals ranges from 0 to 5 percent. Reaction is slightly alkaline or moderately alkaline.

Some pedons have a Cr horizon. This horizon is weathered shale.

Keeter Series

The Keeter series consists of very deep, well drained, loamy soils on upland ridges. These soils formed in unconsolidated stratified sand and stratified weakly cemented sandstone with loamy and shaly materials. Slopes range from 1 to 6 percent. The Keeter soils are fine-silty, siliceous, thermic Udic Haplustalfs.

Typical pedon of Keeter very fine sandy loam, 1 to 6 percent slopes (fig. 18); in Westbrook, from the intersection of Texas Highway 199 and Farm Road 2210, about 2.7 miles south on Farm Road 2210, about 1.0 mile south and east on a county road, 1.1 miles south at the junction, 10 feet east of the county road, in rangeland:

A—0 to 6 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable; many fine and few medium roots; few fine pores; neutral; abrupt smooth boundary.

Bt1—6 to 17 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; moderate medium angular blocky structure; very hard, firm; many fine and few medium roots; many fine pores; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—17 to 25 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; common fine distinct red (2.5YR 4/6) mottles; weak medium prismatic structure parting to weak medium angular blocky; very hard, firm; few fine roots; many fine pores; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

BCt—25 to 31 inches; reddish yellow (5YR 7/8) very fine sandy loam, reddish yellow (5YR 6/8) moist; common fine distinct pink (7.5YR 7/4) mottles; weak medium prismatic structure parting to weak fine angular blocky; hard, friable; few fine roots; common fine pores; about 10 percent sandstone pebbles; common distinct clay films on faces of peds and on surfaces of some sandstone fragments; moderately acid; clear smooth boundary.

C1—31 to 40 inches; very pale brown (10YR 7/4) very fine sandy loam, light yellowish brown (10YR 6/4) moist; common medium distinct reddish yellow (7.5YR 6/6) mottles; massive; weakly cemented; friable; few very fine roots along fractures; neutral; clear wavy boundary.

C2—40 to 80 inches; white (10YR 8/1) unconsolidated sand, white (10YR 8/2) moist; friable; few very fine roots; neutral.

The thickness of the solum and the depth to unconsolidated sand or sandstone range from 20 to 36 inches. The sand fraction consisting of fine sand and coarser material makes up less than 15 percent of the profile. The content of clay in the control section ranges from 25 to 35 percent. The content of siliceous or ironstone pebbles ranges from 0 to 5 percent.

The A horizon is brown or yellowish brown. It ranges from 3 to 6 inches in thickness. Some pedons have an E horizon. This horizon is is light brown or light yellowish brown. It is as much as 5 inches thick. Reaction of the A and E horizons is slightly acid or neutral.

The Bt1 horizon is red or yellowish red. It is clay loam or sandy clay loam. Reaction ranges from strongly acid to slightly acid.

The Bt2 horizon is reddish yellow or yellowish red. It is sandy clay loam or sandy clay. Reaction ranges from strongly acid to slightly acid.

The BCt horizon is light reddish brown, reddish yellow, yellowish red, or light yellowish brown. In some pedons, it is mottled or has a variegated color pattern. Mottles are in shades of red, yellow, or brown. This horizon is very fine sandy loam or sandy clay loam. In some pedons, it has few or common thin discontinuous strata of sandy material or weakly cemented sandstone. Reaction ranges from moderately acid to neutral.

Figure 13.—Profile of Bastsil fine sandy loam. The soil has prismatic structure.

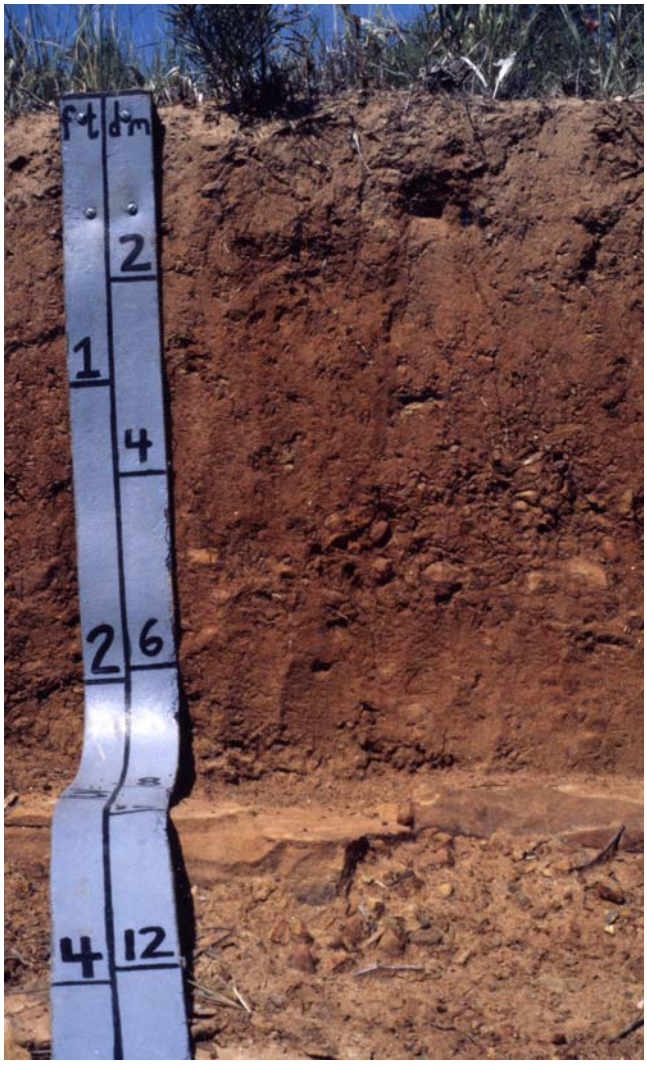

Figure 14.—Profile of Bonti fine sandy loam. The subsoil is red to reddish brown clay that overlies sandstone at a depth of about 3 feet.

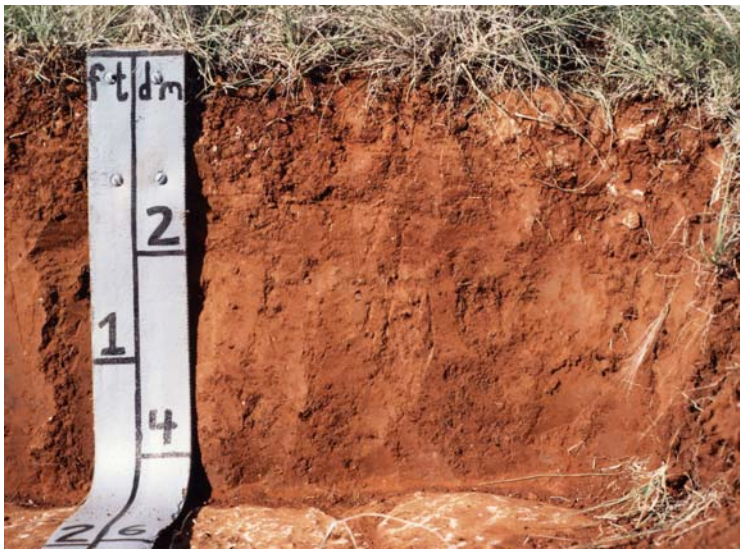

Figure 15.—Profile of Darnell fine sandy loam. A layer of sandstone is at a depth of about 15 inches.

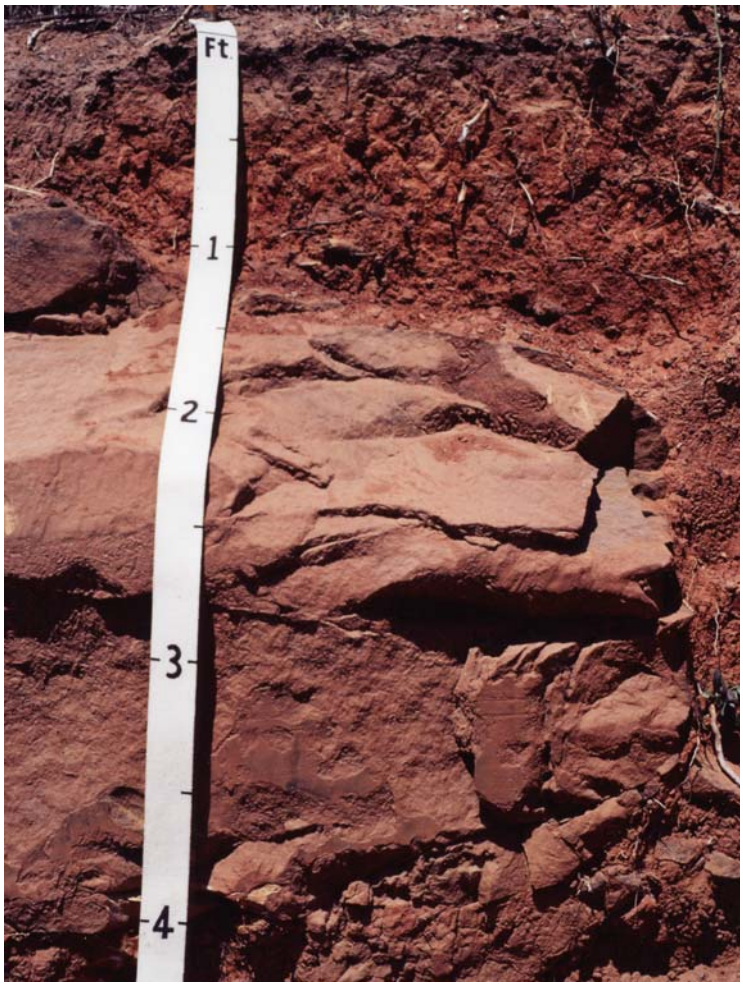

Figure 16.—Profile of Exray fine sandy loam. The subsoil is reddish brown to red and has subangular blocky structure.

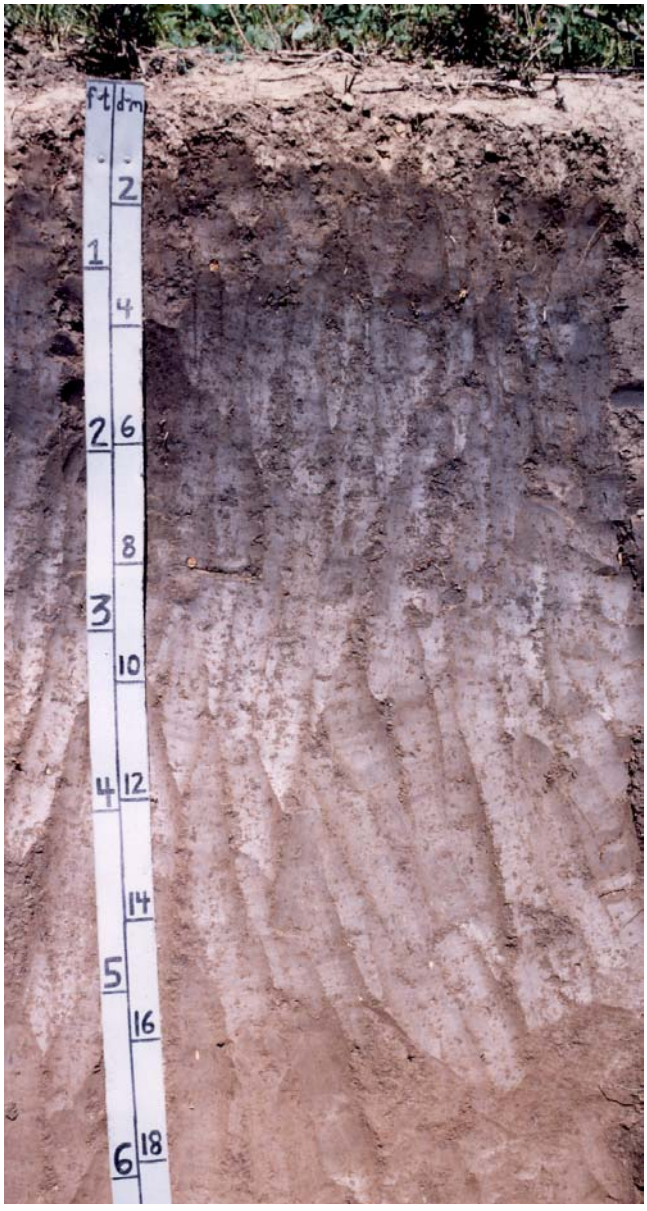

Figure 17.—Profile of Gowen loam. This flood plain soil formed in loamy alluvium along the West Fork of the Trinity River.

Figure 18.—Profile of Keeter very fine sandy loam. Unconsolidated sand occurs at a depth of about 40 inches.

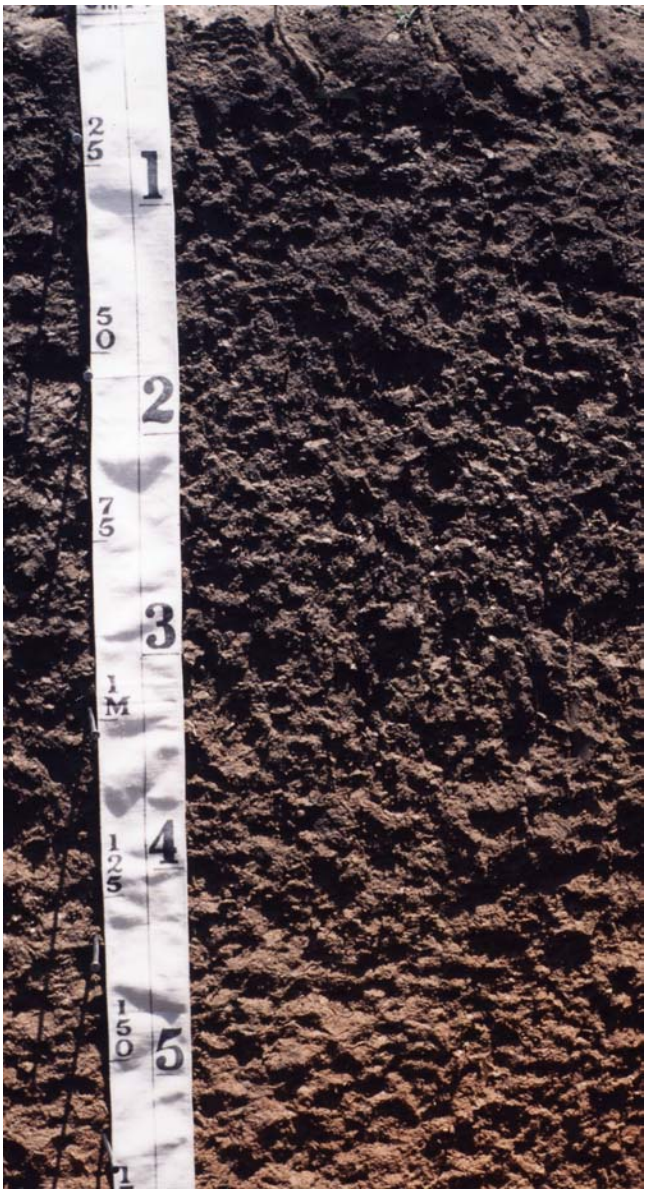

Figure 19.—Profile of Leeray clay. This soil has a very high shrink-swell potential.

Figure 20.—Profile of Minwells fine sandy loam. There is an abrupt boundary between the surface layer and the subsoil.

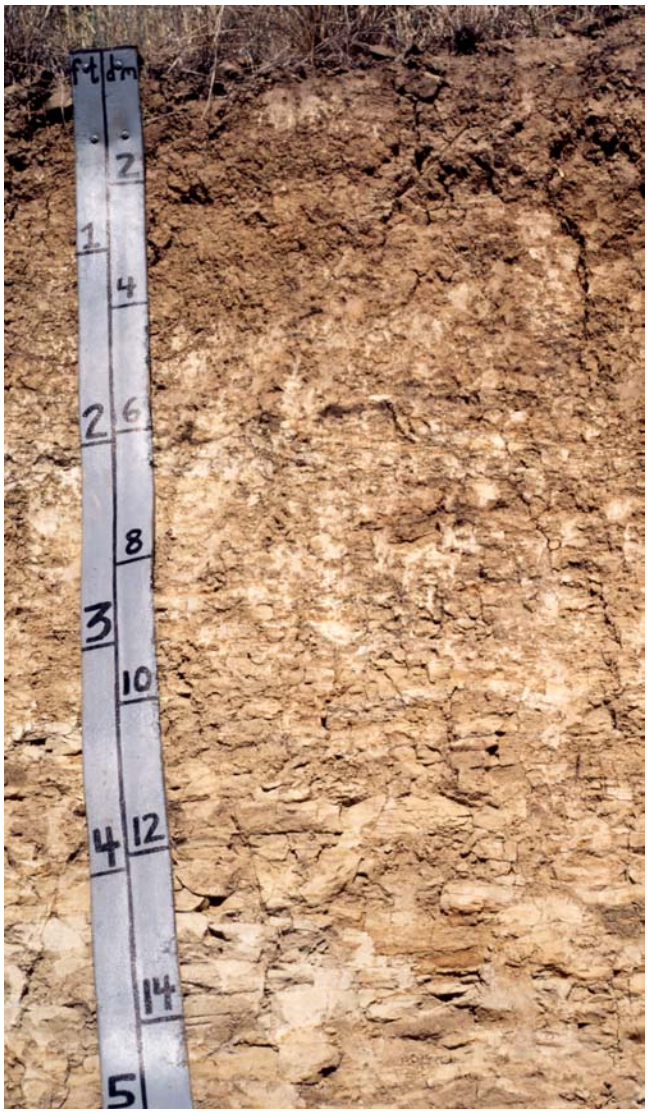

Figure 21.—Profile of Owens clay. Alternating layers of clay and shale are at a depth of about 18 inches.

Figure 22.—Profile of Truce fine sandy loam. This soil is underlain by shale at a depth of about 43 inches.

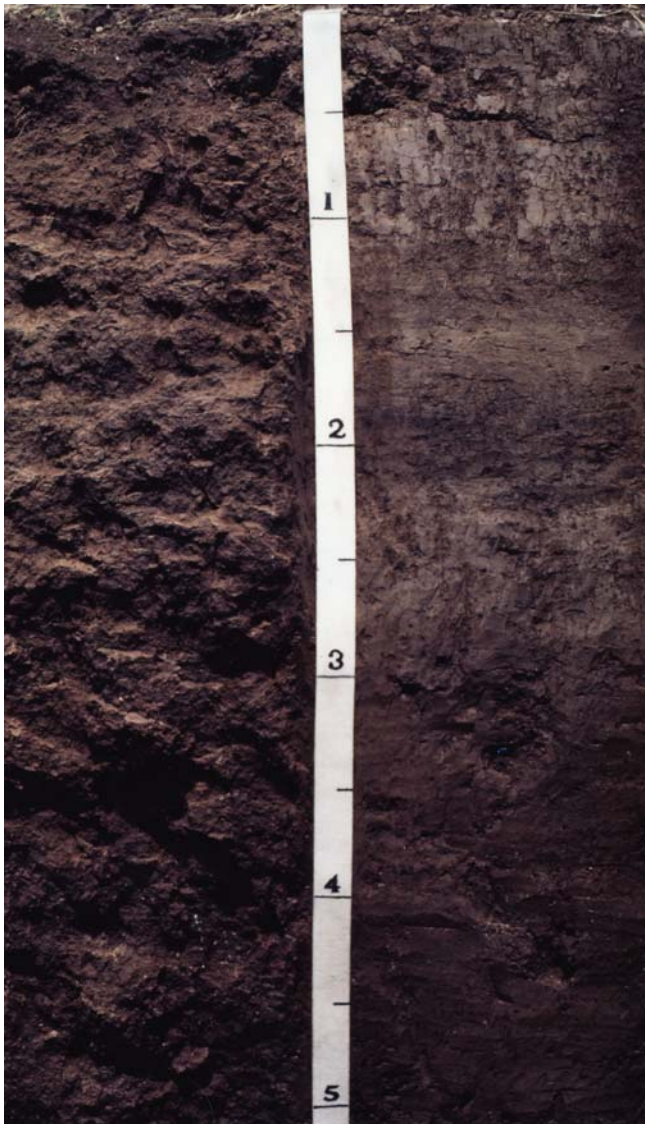

Figure 23.—Profile of Westfork silty clay. This flood plain soil formed in clayey alluvium along the West Fork of the Trinity River.

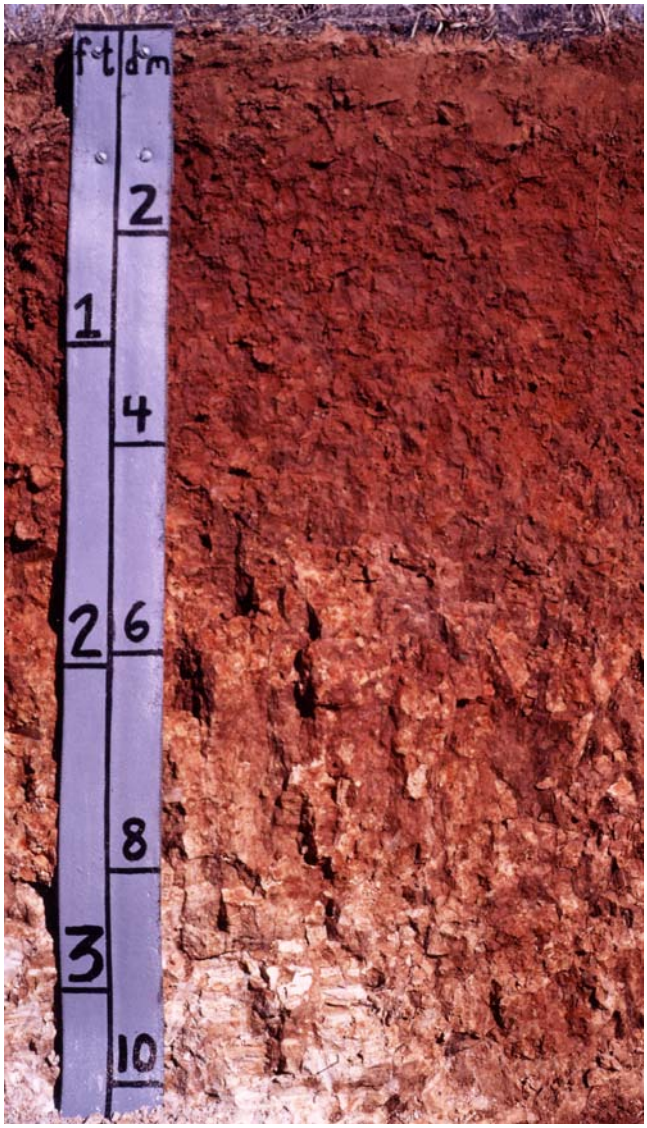

Figure 24.—Profile of Windthorst fine sandy loam. It is difficult for roots to penetrate the lower part of the clayey subsoil and the underlying material.

The C horizon is stratified sandstone or unconsolidated sand in shades of brown, gray, or white. It has none to common mottles in shades of pink, yellow, or brown. In some pedons, the horizon has thin strata of grayish and brownish, loamy or shaly materials. The matrix ranges from loamy fine sand to very fine sandy loam. This material is hard and weakly cemented when dry and friable and slightly brittle when moist. Reaction is neutral or slightly alkaline.

Leeray Series

The Leeray series consists of very deep, well drained, clayey soils on nearly level and very gently sloping uplands. These soils formed in calcareous clay. Slopes range from 0 to 3 percent. The Leeray soils are fine, smectitic, thermic Typic Haplusterts.

Typical pedon of Leeray clay, 0 to 1 percent slopes (fig. 19); from the courthouse in Jacksboro, 2.5 miles west on U.S. Highway 380, about 6.0 miles south on Farm Road 4, about 0.5 mile west on a private road, 0.3 mile south, in rangeland:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; common fine pebbles; common cracks as much as 0.25 inch wide; violently effervescent; moderately alkaline; clear wavy boundary.

A2—6 to 21 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; common fine pebbles; few distinct intersecting slickensides; violently effervescent; moderately alkaline; gradual wavy boundary.

Bss—21 to 42 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; common fine pebbles; many distinct intersecting slickensides; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkss—42 to 52 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; common fine pebbles; many distinct intersecting slickensides; about 3 percent fine rounded calcium carbonate concretions; common very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) streaks; violently effervescent; moderately alkaline; gradual wavy boundary.

BCk—52 to 80 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak coarse angular blocky structure; very hard, very firm, sticky and plastic; common and many fine pebbles; about 15 percent medium rounded calcium carbonate concretions and streaks; violently effervescent; moderately alkaline.

The combined thickness of the A, Bss, and Bkss horizons ranges from 60 to more than 80 inches. When the soil is dry, cracks as much as 2 inches wide extend to a depth of more than 20 inches. In some pedons, the A horizon has chroma of 1 in microdepressions but comprises less than 50 percent of the pedon. The A horizon is thicker in microdepressions and thinner on microknolls. In some microdepressions, the surface layer is noncalcareous.

The A horizon is dark grayish brown, grayish brown, or brown. It is clay. Reaction is slightly alkaline or moderately alkaline. The horizon is strongly effervescent or violently effervescent.

The B horizon is dark brown, grayish brown, brown, yellowish brown, light yellowish brown, or light olive brown. It is clay. It has few to many distinct or prominent intersecting slickensides. The horizon is strongly effervescent or violently effervescent.

The BCk horizon is light olive brown. It is clay. The horizon is strongly effervescent or violently effervescent.

Minwells Series

The Minwells series consists of very deep, well drained, loamy soils on stream terraces. These soils formed in clayey and loamy sediments that are underlain by beds of gravel. Slopes range from 1 to 3 percent. The Minwells soils are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Minwells fine sandy loam, 1 to 3 percent slopes (fig. 20); in Bartons Chapel, from the intersection of Farm Road 4 and Farm Road 2210, about 3.9 miles south on Farm Road 4, about 250 feet west, in rangeland:

A—0 to 10 inches; dark brown (7.5YR 4/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; few fine siliceous pebbles; neutral; abrupt smooth boundary.

Bt1—10 to 21 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; about 5

percent rounded siliceous pebbles; neutral; gradual wavy boundary.

Bt2—21 to 35 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; about 10 percent rounded siliceous pebbles; neutral; gradual wavy boundary.

BC—35 to 45 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, firm; few fine roots; few fine pores; about 10 percent rounded siliceous pebbles; moderately alkaline; gradual wavy boundary.

2C—45 to 60 inches; yellowish red (5YR 5/6) very gravelly sandy loam, yellowish red (5YR 4/6) moist; massive; hard, friable; about 25 percent rounded siliceous pebbles and less than 3 percent angular limestone and chert fragments; slightly alkaline.

The solum ranges from 40 to 60 inches in thickness. The content of clay in the control section ranges from 35 to 40 percent.

The A horizon is dark brown fine sandy loam. Reaction is slightly acid or neutral.

The Bt horizon is red, yellowish red, reddish brown, or reddish yellow. It is sandy clay loam, sandy clay, or clay. Reaction is slightly acid or neutral. Some pedons have a Bk horizon below the Bt horizon.

The BC horizon is reddish yellow, strong brown, or yellowish red. It is clay loam, sandy clay loam, sandy loam, or their gravelly analogues. Reaction is slightly alkaline or moderately alkaline.

The 2C horizon is brown, yellowish red, or brownish yellow. It ranges from sandy loam to sandy clay loam and is gravelly or very gravelly. Rock fragments are as much as 1 inch in diameter and comprise 5 to 30 percent of the horizon. Reaction ranges from neutral to moderately alkaline.

Owens Series

The Owens series consists of soils that are moderately deep to dense, weathered shale. These soils are very deep, well drained, clayey and stony upland soils. They formed in beds of shales and clays. About 12 percent of the surface is covered with sandstone fragments. Slopes range from 5 to 25 percent. The Owens soils are fine, mixed, thermic Typic Haplustepts.

Typical pedon of Owens clay, 5 to 25 percent slopes, very stony (fig. 21); in Bartons Chapel, from the intersection of Farm Road 4 and Farm Road 2210, about 2.6 miles west on a county road, 30 feet north, in rangeland:

A—0 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium angular blocky structure; very hard, firm, very sticky and plastic; many fine and medium roots; common fine pores; about 8 percent stone-sized sandstone fragments; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk—7 to 18 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak medium angular blocky structure; very hard, firm, very sticky and plastic; common fine and medium roots; few fine pores; common wormcasts; about 3 percent fine rounded concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—18 to 80 inches; mottled light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) shale that has clay texture; common medium distinct light olive gray (5Y 6/2) and brownish yellow (10YR 6/8) mottles; massive; very hard, very firm, very sticky and plastic; few fine roots along cracks; about 2 percent fine rounded concretions of calcium carbonate; violently effervescent; moderately alkaline.

The solum ranges from 15 to 35 inches in thickness. The soil is moderately alkaline throughout; however, in some pedons it is noncalcareous in the upper part. Fragments of limestone, sandstone, and ironstone cover 5 to 25 percent of the surface. Stones cover 5 to 15 percent of the surface, pebbles cover 2 to 10 percent, and boulders cover as much as 2 percent.

The A horizon is light olive brown, brown, grayish brown, or light brownish gray. It ranges from 3 to 10 inches in thickness.

The Bk horizon is brownish yellow, olive brown, light olive brown, light brownish gray, brown, yellowish brown, or light yellowish brown. It is clay or silty clay. The content of clay ranges from 35 to 60 percent.

The C horizon is olive, gray, pale olive, or light gray. It is shale that has clay texture, is clay, or is stratified loamy, clayey, and shaly materials. Discontinuous layers of limestone or weakly cemented calcareous sandstone that are 1 to 3 inches thick occur in some pedons.

Palopinto Series

The Palopinto series consists of very shallow and shallow, well drained, loamy and stony soils on

uplands. These soils formed in limestone. Slopes range from 1 to 4 percent. The Palopinto soils are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Typical pedon of Palopinto loam, 1 to 4 percent slopes, extremely stony; from Wizard Wells, 0.6 mile east on Ranch Road 1156, about 1.9 miles east on a county road, 150 feet south of the road, in rangeland:

A1—0 to 6 inches; reddish brown (5YR 4/3) extremely stony loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky and moderate fine granular structure; firm, friable; common fine roots; few fine and very fine pores; few wormcasts and channels; about 60 percent limestone fragments; neutral; clear smooth boundary.

A2—6 to 10 inches; reddish brown (5YR 4/3) extremely stony loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky and moderate fine granular structure; firm, friable; common fine roots; few fine and very fine pores; few wormcasts and channels; about 85 percent limestone fragments; neutral; abrupt wavy boundary.

R—10 to 60 inches; coarsely fractured indurated limestone; roots and soil in fractures.

The thickness of the solum and the depth to indurated limestone range from 6 to 20 inches. Stones cover 20 to 50 percent of the soil surface. The solum contains 35 to 85 percent limestone fragments. Rock fragments are flat, mainly less than 10 inches thick, and 6 to 24 inches across. In some places, the soil has as much as 10 percent flat boulders.

The A horizon is brown or reddish brown. In some pedons, it is slightly effervescent with as much as 2 percent calcium carbonate. Reaction ranges from neutral to moderately alkaline.

The R horizon is hard fractured limestone that is 5 to 100 feet thick.

Pulexas Series

The Pulexas series consists of very deep, well drained, loamy soils on flood plains. These soils formed in stratified loamy alluvium. Slopes are 0 to 1 percent. The Pulexas soils are coarse-loamy, siliceous, nonacid, thermic Typic Ustifluvents.

Typical pedon of Pulexas fine sandy loam, occasionally flooded; in Bartons Chapel, from the intersection of Farm Road 4 and Farm Road 2210, about 1.8 miles west on a county road to a county road bridge, 45 feet southeast of the bridge:

A—0 to 15 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine granular structure; hard, friable; common fine and medium roots; common fine pores; few wormcasts; neutral; abrupt smooth boundary.

C1—15 to 35 inches; light brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; few thin strata of dark brown (10YR 3/3) loam that are thinly to coarsely stratified with many bedding planes; common fine roots; common fine pores; few wormcasts; neutral; gradual smooth boundary.

C2—35 to 50 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable; common thin strata of dark brown (10YR 4/3) loam; common faint bedding planes; few fine roots; few fine and medium pores; few wormcasts and channels; slightly alkaline; gradual smooth boundary.

C3—50 to 80 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; hard, friable; few fine roots; few fine pores; few wormcasts and channels; moderately alkaline.

The A horizon is grayish brown, brown, yellowish brown, pale brown, or light brownish gray. Reaction is slightly acid or neutral.

The C horizon is dark grayish brown, light brown, grayish brown, brown, dark yellowish brown, pale brown, dark brown, yellowish brown, or light yellowish brown. It is fine sandy loam or loam. Some pedons have a dark buried horizon below a depth of 40 inches. The content of clay in the 10- to 40-inch control section is less than 18 percent. Reaction ranges from slightly acid to moderately alkaline.

Rowden Series

The Rowden series consists of moderately deep, well drained, loamy soils on uplands. These soils formed over thick beds of indurated limestone. Slopes range from 0 to 2 percent. The Rowden soils are fine, mixed, thermic Typic Argiustolls.

Typical pedon of Rowden loam, 0 to 2 percent slopes; from the courthouse in Jacksboro, 2.0 miles southeast on U.S. Highway 281, about 3.5 miles east on U.S. Highway 380, about 5.6 miles south on a county road, 600 feet south, in rangeland:

A1—0 to 6 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; hard, firm; many fine roots; common fine pores; common insect nests, tunnels, and wormcasts; neutral; clear smooth boundary.

A2—6 to 16 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, firm, nonsticky; common fine roots; common fine pores; common insect nests, tunnels, and wormcasts; neutral; clear smooth boundary.

Bt1—16 to 30 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium angular blocky structure; very hard, very firm, sticky; many distinct clay films on faces of peds; common fine roots and pores; about 5 percent chert and limestone pebbles; few fine rounded black concretions; neutral; gradual smooth boundary.

Bt2—30 to 38 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm, sticky; many distinct clay films on faces of peds; common fine roots mainly between peds; few fine pores; about 5 percent chert and limestone pebbles; neutral; abrupt wavy boundary.

R—38 to 58 inches; strongly cemented indurated limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches. The content of pebbles and cobbles ranges from 0 to 15 percent in the solum.

The A horizon is dark grayish brown, dark brown, reddish brown, or brown. Reaction ranges from neutral to moderately alkline.

The Bt horizon is reddish brown or red. It is clay loam or clay. The content of clay ranges from 35 to 60 percent. Reaction is slightly alkaline or moderately alkaline.

The R horizon is hard fractured limestone that ranges from 5 to 100 feet in thickness.

Selden Series

The Selden series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in loamy sediments. Slopes range from 1 to 3 percent. The Selden soils are fine-loamy, siliceous, thermic Aquic Paleustalfs.

Typical pedon of Selden loamy fine sand, 1 to 3 percent slopes; in Westbrook, from the intersection of Texas Highway 199 and Farm Road 2210, about 1.4 miles north on Farm Road 2210, about 1.1 miles east on a private road, 500 feet north, in cropland:

Ap—0 to 8 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; common fine and medium roots; slightly acid; clear smooth boundary.

E—8 to 14 inches; very pale brown (10YR 8/4) loamy fine sand, very pale brown (10YR 7/4) moist; single grain; loose; common fine and medium roots; slightly acid; clear wavy boundary.

Bt1—14 to 26 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common fine and medium distinct yellowish red (5YR 5/6), red (2.5YR 4/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very hard, firm; common fine roots; few fine and medium pores; many distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—26 to 36 inches; coarsely mottled red (2.5YR 4/8), brownish yellow (10YR 6/6), and light brownish gray (10YR 6/2) sandy clay loam; weak medium subangular blocky structure; very hard, firm; few fine roots; many distinct clay films on faces of peds; few fine rounded black concretions; few siliceous pebbles; moderately acid; gradual smooth boundary.

Bt3—36 to 62 inches; coarsely mottled brownish yellow (10YR 6/6), reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6), dark red (2.5YR 3/6), and light gray (10YR 7/2) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; few fine roots; many distinct clay films on faces of peds; few fine rounded black concretions; about 1 percent siliceous pebbles; moderately acid; gradual smooth boundary.

BCt—62 to 80 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; common coarse distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; hard, friable; common distinct clay films on faces of peds; about 5 percent chert and sandstone cobbles and stones; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness. The content of clay within the control section ranges from 20 to 35 percent.

The A horizon is light yellowish brown or brown. It is loamy fine sand or fine sand. Reaction ranges from moderately acid to neutral.

The E horizon is light yellowish brown or very pale brown. It is loamy fine sand or fine sand. Reaction ranges from moderately acid to neutral. Some pedons do not have an E horizon.

The Bt horizon is brownish yellow, light brownish gray, or light gray. It is sandy clay loam or clay loam. Reaction ranges from strongly acid to slightly acid.

The BCt horizon is very pale brown. It is fine sand or sandy clay loam. Reaction ranges from strongly acid to slightly acid.

Set Series

The Set series consists of very deep, well drained, clayey and stony soils on uplands. These soils formed in clayey and shaly material. Slopes range from 3 to 30 percent. The Set soils are fine-silty, carbonatic, thermic Typic Calciustolls.

Typical pedon of Set clay, 3 to 5 percent slopes; from the courthouse in Jacksboro, 8.0 miles southeast on U.S. Highway 281, about 0.2 mile southeast on Texas Highway 199, about 200 feet northeast, in rangeland:

A—0 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; many fine and few medium and coarse roots; many fine pores; common wormcasts; slightly effervescent; moderately alkaline; clear wavy boundary.

Bk1—14 to 32 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; hard, firm; common fine and few medium roots; common fine and medium pores; common wormcasts; about 10 percent fine rounded concretions, threads, and soft masses of calcium carbonate; 42 percent calcium carbonate equivalent; about 3 percent limestone cobbles; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—32 to 48 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; common fine and few medium roots; few fine pores; common wormcasts; about 15 percent medium rounded concretions, threads, and soft masses of calcium carbonate; 45 percent of calcium carbonate equivalent; violently effervescent; moderately alkaline; clear wavy boundary.

C—48 to 80 inches; grayish brown (2.5Y 5/2) shale that has clay texture, dark grayish brown (2.5Y 4/2) moist; common light gray (10YR 7/1) streaks and mottles; massive parting to weak platy structure; extremely hard, very firm; about 5 percent medium rounded concretions of calcium carbonate; 15 percent calcium carbonate equivalent; violently effervescent; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The 10- to 40-inch control section is clay or silty clay with calcium carbonate equivalent greater than 40 percent. Limestone cobbles cover as much as 15 percent of the surface.

The A horizon is brown or dark grayish brown. Reaction is slightly alkaline or moderately alkaline.

The Bk horizon is grayish brown, light brownish gray, brown, pale brown, light yellowish brown, light olive brown, or yellowish brown. It is clay or silty clay. The content of concretions and soft masses of calcium carbonate ranges from 2 to 20 percent.

The C horizon is in shades of olive, brown, or gray. It is clay or shale that has clay texture and may be interbedded with loamy materials. The content of concretions and soft masses of calcium carbonate ranges from 2 to 10 percent and decreases as depth increases.

Shatruce Series

The Shatruce series consists of soils that are moderately deep to soft shale. These soils are well drained, loamy upland soils. They formed in material weathered from shale and are on hillsides and escarpments along drainageways. Slopes range from 8 to 50 percent. The Shatruce soils are fine, mixed, thermic Typic Paleustalfs.

Typical pedon of Shatruce gravelly fine sandy loam, 12 to 50 percent slopes, extremely bouldery; in Bartons Chapel, from the intersection of Farm Road 4 and Farm Road 2210, about 3.5 miles west and 2.1 miles north on a county road to a metal gate on the east side of the road, 0.3 mile east on a private ranch road, 50 feet south, in rangeland:

A—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine subangular blocky structure; slightly hard, friable; many fine roots; about 20 percent siliceous pebbles; neutral; clear wavy boundary.

E—3 to 6 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; single grain; loose; common fine and medium roots; about 20 percent siliceous pebbles; neutral; abrupt wavy boundary.

Bt1—6 to 15 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; few fine and medium roots; many distinct clay films on faces of peds; moderately acid; gradual wavy boundary.

Bt2—15 to 25 inches; yellow red (5YR 4/6) clay, yellowish red (5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; few

fine roots; many distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.
BCt—25 to 35 inches; light reddish brown (2.5YR 6/4) clay, reddish brown (2.5YR 5/4) moist; weak fine angular blocky structure; very hard, very firm; few fine roots; common distinct clay films on faces of peds; slightly acid; gradual wavy boundary.
C—35 to 80 inches; light yellowish brown (2.5Y 6/4) shale that has clay texture, light olive brown (2.5Y 5/4) moist; stratified with thin layers of red, brown, and olive shale; slightly acid.

The solum ranges from 20 to 40 inches in thickness. Boulders cover as much as 35 percent of the surface, and stones cover 5 to 35 percent. Boulders and stones can cover as much as 50 percent on the upper slopes. The boulders and stones range from 10 inches to 6 feet across the long axis and are 3 inches to 6 feet thick. They range from conglomerate to fine-grained sandstone cemented with silica and iron oxide.

The A horizon is dark grayish brown, brown, or pale brown. The E horizon is light brownish gray, light yellowish brown, pale brown, or very pale brown. The content of siliceous and sandstone gravel ranges from 15 to 25 percent in the A and E horizons. Reaction is slightly acid or neutral.

The Bt horizon is red or yellowish red. The Bt and BCt horizons are clay or sandy clay. The content of clay ranges from 35 to 50 percent. Stones and cobbles comprise as much as 5 percent of the horizons. Reaction ranges from strongly acid to slightly acid in both horizons.

The C horizon is clay or shale that has clay texture. It is in shades of brown, yellow, or olive. Reaction ranges from strongly acid to slightly acid. This horizon ranges from 20 to 100 feet in thickness.

Stephenville Series

The Stephenville series consists of moderately deep, well drained, loamy soils on uplands. These soils formed from weathered sandstone. Slopes range from 1 to 5 percent. The Stephenville soils are fine-loamy, siliceous, thermic Ultic Haplustalfs.

Typical pedon of Stephenville fine sandy loam, 1 to 5 percent slopes; from the courthouse in Jacksboro, 4.9 miles west on U.S. Highway 380, about 0.9 mile north and west on a county road, 1.1 miles north on the county road, 200 feet west, in rangeland:

A—0 to 8 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak very fine subangular blocky structure; hard, friable; common fine roots; slightly acid; gradual smooth boundary.
Bt1—8 to 18 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; very hard, friable; common fine roots; few fine pores; common distinct clay films on faces of peds; about 2 percent weakly cemented sandstone pebbles and cobbles; moderately acid; clear smooth boundary.
Bt2—18 to 25 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; very hard, friable; common fine roots; few fine pores; common distinct clay films on faces of peds; moderately acid; abrupt wavy boundary.
Cr—25 to 45 inches; strong brown (7.5YR 5/6) weakly cemented sandstone that becomes harder as depth increases.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is dark brown, brown, yellowish brown, or dark yellowish brown. It is fine sandy loam. Reaction is moderately acid or slightly acid.

Some pedons have an E horizon. This horizon is light brown or brown. It is fine sandy loam. Reaction is moderately acid or slightly acid.

The Bt horizon is red, yellowish red, or reddish brown. It is sandy clay loam. Reaction is moderately acid or slightly acid.

The Cr horizon is red and yellowish red weakly cemented sandstone. Cementation increases as depth increases, and the sandstone becomes very hard. In most pedons, layers of clayey or shaly material ranging from 3 to 12 inches in thickness are interbedded in the sandstone. These layers are 1 foot to more than 5 feet apart vertically.

Thurber Series

The Thurber series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in calcareous clayey alluvium. Slopes range from 0 to 2 percent. The Thurber soils are fine, smectitic, thermic Typic Haplustalfs.

Typical pedon of Thurber clay loam, 0 to 2 percent slopes; in Perrin, from the intersection of U.S. Highway 281 and Farm Road 2210, about 1.9 miles south on U.S. Highway 281, about 0.1 mile west on a private road, 50 feet south, in rangeland:

A—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; very hard, firm; many fine roots; common fine pores; common wormcasts; neutral; clear smooth boundary.
Bt—6 to 24 inches; dark grayish brown (10YR 4/2)

clay, very dark grayish brown (10YR 3/2) moist; strong medium angular blocky structure; extremely hard, very firm; many fine roots; many distinct clay films on faces of peds; neutral; clear smooth boundary.

Btk—24 to 41 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/3) moist; moderate fine angular blocky structure; extremely hard, very firm; few fine roots; many distinct clay films on faces of peds; few fine rounded concretions and soft masses of calcium carbonate; few fine rounded black concretions; slightly effervescent; moderately alkaline; gradual wavy boundary.

BCk1—41 to 50 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak fine angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; few wormcasts; many fine rounded concretions and soft masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

BCk2—50 to 80 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine angular blocky structure; hard, friable; slightly effervescent; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness. The depth to films, threads, concretions, or soft masses of calcium carbonate ranges from 15 to 28 inches. The content of calcium carbonate masses ranges from 2 to 10 percent.

The A horizon is brown, dark grayish brown, or dark brown. It is hard and massive when dry. It ranges from 4 to 12 inches in thickness. Reaction ranges from slightly acid to slightly alkaline.

The Bt and Btk horizons are dark grayish brown, dark yellowish brown, brown, dark brown, yellowish brown, grayish brown, or light olive brown. They are clay loam or clay. Reaction ranges from neutral to moderately alkaline.

The BCk horizon is light olive brown, light yellowish brown, pale brown, pale olive, or brown. It is calcareous clay loam or clay. In some pedons, it contains fragments of shale. The content of concretions and soft masses of calcium carbonate ranges from 2 to 10 percent in the BCk horizon and from 0 to 5 percent in the Ck horizon. Reaction is slightly alkaline or moderately alkaline.

Treadway Series

The Treadway series consists of very deep, well drained, clayey soils on uplands. These soils formed in calcareous and saline, clayey alluvial sediments. Slopes range from 0 to 2 percent. The Treadway soils are fine, mixed, thermic Torrertic Haplustepts.

Typical pedon of Treadway silty clay loam, 0 to 2 percent slopes; north of Antelope, from the intersection of Texas Highway Loop 187 and Farm Road 175, about 2.5 miles east on Farm Road 175, about 1.5 miles south and east on a county road, 800 feet north, in rangeland:

A—0 to 11 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak thin platy structure in upper 2 inches of horizon and weak coarse angular blocky structure in lower part; extremely hard, extremely firm, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; few films, threads, and masses of gypsum and other salts in lower part of horizon; cracks 0.5 to 1.0 centimeter wide; slightly saline; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—11 to 34 inches; yellowish red (5YR 5/6) clay, dark reddish brown (5YR 3/4) moist; weak coarse angular blocky structure; extremely hard, extremely firm, sticky and plastic; few fine roots mostly in cracks; about 5 percent films, threads, and masses of calcium carbonate and other salts; about 3 percent gypsum crystals; cracks 0.5 to 1.0 centimeter wide; about 1 percent shale fragments less than 5 millimeters in size; moderately saline; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—34 to 60 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; massive; extremely hard, extremely firm, sticky and plastic; about 10 percent films, threads, and masses of calcium carbonate and other salts; about 5 percent gypsum crystals; about 2 percent shale fragments less than 5 millimeters in size; moderately saline; slightly effervescent; moderately alkaline.

Reaction is moderately alkaline or strongly alkaline throughout the profile.

The A horizon is brown or reddish brown. Electrical conductivity ranges from 2 to 8 millimhos per centimeter. During dry periods, to a depth of 1 inch in the soil, it can be as high as 40 millimhos per centimeter.

The Bw horizon is brown, strong brown, reddish brown, yellowish red, or red. Electrical conductivity ranges from 2 to 8 millimhos per centimeter.

The C horizon is brown, strong brown, reddish brown, yellowish red, or red. It is clay or shale that has clay texture. In some pedons, this horizon is stratified with shaly, silty, clayey, loamy, or sandy materials.

Electrical conductivity ranges from 4 to 16 millimhos per centimeter in the lower part. The horizon ranges from 3 to 30 feet in thickness.

Truce Series

The Truce series consists of soils that are deep to weathered shale. These soils are well drained and are on uplands. They formed in materials weathered from shale. Slopes range from 1 to 5 percent. The Truce soils are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Truce fine sandy loam, 1 to 5 percent slopes (fig. 22); from the courthouse in Jacksboro, 1.0 mile north and west on U.S. Highway 281, about 16.0 miles north on Texas Highway 148, about 1.7 miles west on a county road, 2.2 miles southwest on a private road, 30 feet northeast, in rangeland:

A—0 to 6 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; hard, friable; few fine roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 18 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; very hard, firm; few fine roots; many distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—18 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; many distinct clay films on faces of peds; few fine rounded black concretions; slightly alkaline; clear wavy boundary.

Bt3—25 to 32 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots mainly between peds; many distinct clay films on faces of peds; common fine rounded black concretions; slightly alkaline; gradual wavy boundary.

BC—32 to 43 inches; yellowish brown (10YR 4/4) clay, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure; extremely hard, very firm; 2 percent soft masses of calcium carbonate; slightly effervescent; moderately alkaline; clear wavy boundary.

C—43 to 65 inches; light olive brown (2.5Y 5/4) shale that has clay texture, light olive brown (2.5Y 4/4) moist; massive to weak fine platy structure; brittle; 2 percent fine rounded concretions and soft masses of calcium carbonate; slightly effervescent; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is brown, dark brown, yellowish brown, light brown, or dark grayish brown. Reaction is slightly acid or neutral.

The Bt horizon is brown, yellowish brown, reddish brown, yellowish red, or red. Reaction is neutral or slightly alkaline.

The BC horizon is dark yellowish brown, yellowish brown, brown, light yellowish brown, brownish yellow, or light gray. Reaction ranges from neutral to moderately alkaline. In most pedons, the horizon is slightly effervescent. The content of concretions and soft masses of calcium carbonate ranges from 0 to 3 percent.

The C horizon is in shades of olive, brown, yellow, or gray. In some pedons, it occurs as discontinuous layers of limestone or weakly cemented calcareous or noncalcareous sandstone that are 1 to 3 inches thick. Reaction is slightly alkaline or moderately alkaline. The horizon is slightly effervescent; however, it is noncalcareous in a few pedons. The horizon ranges from 20 to 100 feet in thickness.

Vernon Series

The Vernon series consists of soils that are moderately deep to weathered shale. These soils are well drained, clayey upland soils. They formed in calcareous clayey material. Slopes range from 3 to 8 percent. The Vernon soils are fine, mixed, thermic Typic Haplustepts.

Typical pedon of Vernon clay, 3 to 8 percent slopes; from the courthouse in Jacksboro, 15.8 miles southeast on Texas Highway 199, about 75 feet south of the highway, in rangeland:

A—0 to 6 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; weak fine granular structure; very hard, firm, very sticky and plastic; many fine and medium roots; few fine pores; few limestone pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw1—6 to 23 inches; reddish brown (2.5YR 5/4) clay, dark reddish brown (2.5YR 4/4) moist; moderate fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few fine pores; about 2 percent fine rounded concretions of calcium carbonate; few medium limestone pebbles; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bw2—23 to 34 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate

fine and medium angular blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; about 2 percent fine rounded concretions and masses of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

C—34 to 60 inches; weak red (10R 5/4) shale that has clay texture, weak red (10YR 4/4) moist; massive; very hard, very firm, very sticky and plastic; few shale fragments; slightly effervescent; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. The soil is moderately alkaline and is slightly effervescent throughout; however, it is noncalcareous to a depth of a few inches in a few pedons.

The A horizon is red, reddish brown, grayish brown, dark reddish gray, or dark brown. The content of clay ranges from 40 to 60 percent.

The Bw horizon is reddish brown, red, grayish brown, light brownish gray, or weak red. It is silty clay or clay. The horizon contains as much as 10 percent calcium carbonate in the form of films, threads, soft masses, and concretions.

The C horizon is weak red, light reddish brown, reddish brown, or light gray. It is soft shale or clay. In some pedons, it has 5 to 10 percent soft masses and concretions of calcium carbonate. Reaction ranges from neutral to moderately alkaline. Fragments and strata of greenish and reddish shale or clay material occur in some pedons below a depth of 60 inches. The C horizon ranges from 3 to 30 feet in thickness.

Westfork Series

The Westfork series consists of very deep, well drained, clayey soils on flood plains. These soils formed in loamy and clayey alluvial sediments. Slopes are 0 to 1 percent. The Westfork soils are fine, mixed, thermic Cumulic Haplustolls.

Typical pedon of Westfork silty clay, frequently flooded (fig. 23); from the courthouse in Jacksboro, 1.0 mile north and west on U.S. Highway 281, about 9.4 miles north on Texas Highway 148, about 0.5 mile east on a gravel oil field road, 0.2 mile east on a private road, 30 feet north, in rangeland:

A1—0 to 6 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine and many very fine roots; common very fine pores; neutral; clear smooth boundary.

A2—6 to 21 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; common very fine pores; slightly alkaline; clear smooth boundary.

A3—21 to 28 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; few fine faint dark reddish brown mottles; weak fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine pores; moderately alkaline; clear smooth boundary.

A4—28 to 40 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; few fine dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; moderately alkaline; gradual smooth boundary.

Bk—40 to 53 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine threads and very fine rounded concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

BCk—53 to 80 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; common threads and few very fine concretions of calcium carbonate; strongly effervescent; moderately alkaline.

The mollic epipedon ranges from 20 to about 60 inches in thickness. The depth to secondary calcium carbonate ranges from 28 to 60 inches. Dry-weather cracks that are as much as 5 centimeters wide extend to a depth of about 18 inches. The coefficient of linear extensibilty is less than 0.07 inch. The control section and all horizons have 35 to 60 percent clay with textures of silty clay loam, silty clay, or clay.

The A1 and A2 horizons are reddish gray, dark reddish gray, reddish brown, dark reddish brown, grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. Reaction ranges from slightly acid to slightly alkaline.

The A3 and A4 horizons are reddish gray, dark reddish gray, reddish brown, yellowish red, yellowish brown, dark yellowish brown, dark reddish brown, grayish brown, olive brown, light olive brown, dark grayish brown, very dark grayish brown, brown, or dark brown. Reaction ranges from slightly acid to moderately alkaline.

The Bk and BCk horizons are reddish gray, dark reddish gray, reddish brown, yellowish red, yellowish brown, dark yellowish brown, dark reddish brown,

grayish brown, olive brown, light olive brown, dark grayish brown, very dark grayish brown, brown, or dark brown. These horizons are moderately alkaline and calcareous.

Some pedons have a C horizon. This horizon is reddish gray, dark reddish gray, dark reddish brown, reddish brown, brown, or dark brown. Reaction ranges from neutral to moderately alkaline. Some pedons have loamy strata below a depth of 40 inches.

Windthorst Series

The Windthorst series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in stratified clayey, sandy, and loamy materials. Slopes range from 1 to 5 percent. The Windthorst soils are fine, mixed, thermic Udic Paleustalfs.

Typical pedon of Windthorst fine sandy loam, 1 to 5 percent slopes (fig. 24); in Perrin, from the intersection of U.S. Highway 281 and Farm Road 2210, about 1.7 miles east on Farm Road 2210, about 3.6 miles north and east on a county road, 40 feet north, in rangeland:

A—0 to 5 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky and granular structure; soft, very friable; many fine and medium and few coarse roots; common fine pores; slightly acid; abrupt smooth boundary.

Bt1—5 to 14 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; common fine and medium roots; common fine and very fine pores; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—14 to 23 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; common medium distinct red and strong brown mottles; weak prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; common fine and very fine roots; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—23 to 33 inches; strong brown (7.5YR 5/8) sandy clay, strong brown (7.5YR 4/6) moist; common medium distinct red mottles; moderate coarse prismatic structure; extremely hard, very firm; few very fine roots; many distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

BCt1—33 to 44 inches; mottled yellowish red (5YR 4/6) and pink (5YR 7/3) sandy clay; common medium distinct red mottles; moderate coarse prismatic structure; extremely hard, very firm; few very fine roots; many distinct clay films on faces of peds; slightly acid; gradual smooth boundary.

BCt2—44 to 58 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure; very hard, firm; few very fine roots; common distinct clay films on faces of peds; slightly alkaline; gradual smooth boundary.

C1—58 to 64 inches; pale yellow (7.5YR 7/4) sandy clay loam, light yellowish brown (7.5YR 6/4) moist; massive; very hard, very firm; slightly alkaline; gradual smooth boundary.

C2—64 to 80 inches; very pale brown (10YR 8/3) weakly cemented sandstone, very pale brown (10YR 7/3) moist; massive; neutral.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is dark grayish brown or yellowish brown. Reaction is slightly acid or neutral.

Some pedons have an E horizon. This horizon is reddish yellow, very pale brown, or light brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, red, yellowish red, brown, or strong brown. Mottles in shades of yellow, brown, pink, or red range from few to many in the lower part of the horizon. Grayish mottles are in some pedons below a depth of 30 inches. The Bt horizon is clay, sandy clay, or clay loam. Reaction ranges from moderately acid to neutral.

The BCt horizon is in shades of red, yellow, or brown. It is sandy clay, sandy clay loam, or clay loam. Reaction ranges from moderately acid to moderately alkaline.

The C horizon is in shades of white, yellow, or brown. It ranges from sandy clay loam to weakly cemented sandstone. As depth increases, the C horizon commonly grades to weakly cemented sandstone interbedded with loamy or clayey materials. Reaction ranges from slightly acid to moderately alkaline. The horizon ranges from 3 to 20 feet in thickness.

Winters Series

The Winters series consists of very deep, well drained, loamy soils on uplands. These soils formed in loamy and clayey alluvial material. Slopes range from 1 to 3 percent. The Winters soils are fine, mixed, thermic Typic Paleustalfs.

Typical pedon of Winters loam, 1 to 3 percent slopes; in Perrin, from the intersection of U.S. Highway 281 and Farm Road 2210, about 0.9 mile south on

U.S. Highway 281, about 1.3 miles west on a county road, 360 feet north, in rangeland:

A—0 to 8 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, very friable; many fine roots; many fine pores; slightly acid; clear smooth boundary.

Bt1—8 to 18 inches; reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; weak medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; many distinct clay films on faces of peds; few wormcasts and common insect nests and tunnels; slightly acid; clear smooth boundary.

Bt2—18 to 25 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; common fine roots; many distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt3—25 to 38 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate medium angular blocky structure; very hard, very firm; common very fine roots; many distinct clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bt4—38 to 48 inches; reddish yellow (5YR 6/6) sandy clay, yellowish red (5YR 5/6) moist; moderate fine subangular blocky structure; very hard, very firm; few very fine roots; many distinct clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Btk—48 to 64 inches; reddish yellow (5YR 7/6) sandy clay, reddish yellow (5YR 6/6) moist; weak fine subangular blocky structure; very hard, very firm; common distinct clay films on faces of peds; common fine hard and soft calcium carbonate masses; strongly effervescent; moderately alkaline; gradual wavy boundary.

B´t—64 to 80 inches; reddish yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) moist; weak medium subangular blocky structure; hard, friable; few hard and soft masses of calcium carbonate; strongly effervescent; moderately alkaline.

The solum is more than 60 inches thick. The depth to the calcic horizon is more than 45 inches.

The A horizon is brown or reddish brown. Reaction is slightly acid or neutral.

The Bt horizon is reddish brown, yellowish red, red, or reddish yellow. It is loam, sandy clay, or clay. Reaction ranges from slightly acid to moderately alkaline.

The Btk horizon is light reddish brown, light red, reddish brown, red, light reddish brown, reddish yellow, or yellowish red. It is sandy clay loam, clay loam, clay, or sandy clay. The calcium carbonate equivalent ranges from 10 to 25 percent. Visible forms of calcium carbonate are mostly in soft powdery masses and concretions.

The B´t horizon is in shades of red, yellow, or brown. It is sandy clay loam, clay loam, clay, or sandy clay. Reaction ranges from slightly acid to moderately alkaline.

Wise Series

The Wise series consists of very deep, well drained, loamy soils on uplands. These soils formed in stratified, calcareous, loamy and shaly marine sediments. Slopes range from 3 to 5 percent. The Wise soils are fine-silty, siliceous, thermic Udic Haplustepts.

Typical pedon of Wise loam, 3 to 5 percent slopes; in Westbrook, from the intersection of Texas Highway 199 and Farm Road 2210, about 2.7 miles south on Farm Road 2210, about 1.0 mile south and east on a county road, 0.1 mile south on a county road, 20 feet east, in rangeland:

A—0 to 8 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable; many fine and very fine roots; common wormcasts; many fine and very fine pores; about 2 percent fine rounded concretions of calcium carbonate; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—8 to 17 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable; common fine and very fine roots; common wormcasts; few very fine pores; about 8 percent fine rounded concretions and soft masses of calcium carbonate; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Bk2—17 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; very hard, firm; common very fine roots; common very fine pores; about 8 percent fine rounded concretions and soft masses of calcium carbonate less than 1 inch in diameter; violently effervescent; moderately alkaline; clear smooth boundary.

Ck—26 to 60 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; common medium distinct yellowish brown (10YR 5/6)

mottles; massive; very hard, firm; few fine roots along cleavage planes; about 3 percent fine rounded concretions and soft masses of calcium carbonate; thin strata of soft calcareous sandstone; strongly effervescent; moderately alkaline.

The solum ranges from 20 to 35 inches in thickness.

The A horizon is brown or dark grayish brown.

The B horizon is pale brown, brown, or light yellowish brown.

The C horizon contains fragments of shale or soft calcareous sandstone. In some pedons, it has strata 0.5 inch to 4.0 inches thick of soft calcareous sandstone or weakly cemented to strongly cemented limestone. A sandy layer is below a depth of 40 inches in some pedons. It is mainly very fine sand or loamy very fine sand and is unconsolidated or weakly cemented.

Formation of the Soils

This section discusses the factors of soil formation and how they relate to the soils in the survey area. It also discusses the surface geology of the survey area.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geological forces. The characteristics of the soil at any given place are determined by the physical and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the material. Although all five factors influence the present characteristics of every soil, the significance of each factor varies from one place to another.

Parent material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineral composition of the soil. The soils of Jack County developed from parent material that was deposited by water or deposited in water. Most of the soils formed from parent materials deposited during the Pennsylvanian and Cretaceous geological periods (fig. 25). The parent materials include hard crystalline limestone (in which Palopinto and Hensley soils developed), softer limestone interbedded with chalk and marls (in which Aledo soils developed), hard sandstones (in which Bonti, Darnell, and Exray soils developed), soft and weakly consolidated sandstone (in which Keeter and Wise soils developed), soft shale (in which Owens and Truce soils developed), loamy and clayey sediments (in which Anocon, Leeray, and Thurber soils developed), and calcareous shale, clay, and marl (in which Set soils developed).

Other soils formed from parent materials deposited during the Quaternary geological period. The Quaternary period can be divided into the Pleistocene and Holocene ages. Parent materials deposited during the Pleistocene age are on ancient stream terraces above present-day flood plains. These parent materials include sandy and loamy sediments (in which Bastsil soils developed). The Holocene-age parent materials are on flood plains of streams. They include sandy and loamy sediments (in which Pulexas and Gowen soils developed) and calcareous loamy and clayey sediments (in which Bosque and Westfork soils developed). Additional information about the parent materials of Jack County is given under “Surface Geology.”

Climate

Climate contributes to the formation of soils in several ways. High temperatures, periods of high humidity, and adequate amounts of rainfall encourage the deep penetration of water into the earth’s crust. Moisture and warm temperatures favor the development and deep penetration of plant roots, the activity of micro-organisms, and chemical weathering. Because the survey area has these conditions, many deep soils formed in Jack County. Calcium and other chemicals have been removed from some soils through leaching. Leaching produces soils that are low in certain essential plant nutrients.

Rainfall cycles cause the soils to be alternately wet and dry. When clayey soils, such as Leeray soils, become dry, they crack because the loss of moisture causes the soil to shrink. The next rainfall washes some of the surface layer into these cracks. As the soil adsorbs the water, the soil swells and the cracks shut. This alternate wetting and drying of the soil causes the soil to shrink and swell. The shrinking and swelling causes the soil to churn, which prevents the accumulation of clay in any particular horizon. Other soils, such as Hassee, Thurber, Truce, and Windthorst soils, have clayey subsoils. Water moving through these soils detaches clay particles from the surface layer and deposits them in lower layers as water movement slows. As clay accumulates, the water moves more slowly and the deposition of clay

Figure 25.—Alternating layers of limestone and marl that vary in thickness. Soil formation is very difficult and slow in areas of this parent material.

accelerates. Thus, the process tends to speed up, and the lower layers become more clayey.

Plant and Animal Life

Vegetation, animals, micro-organisms, earthworms, and other organisms, including humans, living on or in the soil contribute to its development. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are caused by living organisms. In the nearly treeless prairies of Jack County, tall grasses have influenced soil development more than other plants. These grasses provided litter that protected the surface and added organic matter that darkened soils, such as Anocon, Leeray, Set, and Thurber soils. The grass roots reached deep into the soil and used minerals at the lower depths. Lime, other minerals, and organic matter were distributed throughout the soil profile as these plants died and decomposed. The decomposed plant roots left channels that increased rates of water intake and aeration of the soil. Earthworms and other soil organisms fed on the decomposed roots. The borings of earthworms also helped to channel water and air through the soil.

In areas of the county where the native vegetation is mostly oak-savannah, organic matter has mainly accumulated to a depth of only a few inches. This organic matter is quickly destroyed if the soil is cultivated. Soils in these areas, such as Chaney, Keeter, and Windthorst soils, have a light-colored surface layer and are acid in the upper part of the subsoil. Burrowing animals, such as worms, ants, gophers, and badgers, help mix soil and parent material.

Tillage and grazing animals also influence soil formation. Much of the savannahs and prairies has been cleared for cropland. Cultivation has encouraged runoff and erosion and reduced the content of organic matter. Tillage and continuous grazing have compacted the clayey soils and reduced aeration, infiltration, and permeability. These changes are reflected in the present productivity of soils and will have some effects on the rate and kinds of future development of the soils.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The relief in Jack County ranges from nearly level to steep. On nearly level and gently sloping soils, such as Hassee soils, most of the rainfall enters the soil, allowing deep development.

Some of the steeper sloping soils, such as Owens and Shatruce soils, lose soil material almost as rapidly as soil formation occurs because of erosion. The surface layer remains thin and light in color. The solum of these soils is not as thick as the solum of those soils that formed on less sloping topography.

Some soils, such as Bosque, Gowen, Pulexas, and Westfork, are affected by relief in another way.

Flooding on these soils deposits sediments from the surrounding watersheds.

The sloping to moderately steep soils that are on east- and north-facing slopes have a thicker and darker surface layer than those on south- and west-facing slopes. Where slopes are less exposed to sunlight, the soil temperature is lower and more organic matter accumulates.

Time

Time, usually a very long time, is required for the formation of soils that have distinct horizons. However, the effects of time are modified by the other four factors of soil formation. The differences in the length of time that parent materials have been in place are generally reflected in the degree of development of the soil profile. The soils in Jack County range from young to old. The young soils have very little horizon development, and the older soils have well expressed soil horizons.

Pulexas soils are examples of young soils that show little profile development. The soil horizons still show the evidence of stratification, and little change has occurred in the original stream-deposited alluvium. Older soils, such as Chaney and Selden soils, have well developed soil horizons. The parent materials of these soils have been in place long enough for the downward movement and accumulation of clay-sized particles to develop distinct Bt horizons.

Surface Geology

The soils in Jack County developed from parent materials derived from Pennsylvanian-age and Cretaceous-age sedimentary rock formations and Quaternary-age sediments *(3, 4)*. Pennsylvanian and Cretaceous formations consist of conglomerate, sandstone, shale, mudstone, and limestone strata with varying degrees of consolidation. Quaternary sediments in the county dominantly consist of unconsolidated gravel, sand, and clay alluvium deposited by the current surface drainage system.

Pennsylvanian Strata

The oldest rocks cropping out in Jack County are strata in the Canyon Group. Canyon Group formations crop out in the southeastern half of the county. The outcrop contact between the younger Cisco Group to the northwest and the Canyon Group trends in a southwest-northeasterly direction and passes through the city of Jacksboro.

Pennsylvanian strata in Jack County generally have a southwest-northeasterly strike. This strike is indicated by the outcrop contact trend between the Canyon Group and the Cisco Group as well as the patterns and locations of soil map units delineated on the general soil map. The dip is in a northwesterly direction at approximately 50 to 55 feet per mile. The dip and combined thickness of the Canyon Group and Cisco Group are fairly constant. There is, however, a substantial variance in thickness and outcrop width in individual formations *(3, 4, 6)*.

Conglomerate, sandstone, shale, mudstone, and limestone strata and several coal beds indicate fluvial, deltaic, shoreline, lagoonal, and shallow marine depositional environments. Numerous unnamed Pennsylvanian-age consolidated gravel, sand, and clay channel deposits are within or on named formations. Some of these deposits extend across formational contacts. The dispersed and complex outcrop patterns of these deposits are reflected on the general soil map.

Canyon Group. The following paragraphs describe the formations, from oldest to youngest, in the Canyon Group.

The Palopinto Formation is the oldest formation cropping out in Jack County. Its outcrop is in the southeastern part of the county where it is overlain along its eastern extremity by the Cretaceous-age Twin Mountains Formation. The Palopinto Formation is comprised of shale, sandstone, and limestone beds. The Wiles Limestone Member and the Oran Sandstone Member, at the top and middle of the formation, respectively, are mapped separately *(3)*.

The Wolf Mountain Shale crops out adjacent to and northwest of the Palopinto Formation. It is also overlain by the Twin Mountains Formation along its eastern extremity. The Wolf Mountain Shale contains thin- to thick-bedded sandstone lenses and argillaceous limestone lentils.

The Jasper Creek Formation crops out in the extreme eastern part of Jack County *(4)*. It is overlain by the Twin Mountains Formation at its southern extremity. The Jasper Creek Formation is equivalent to the lower part of the Wolf Mountain Shale. The Palopinto Formation outcrops on the western edge of the overlapping Twin Mountains Formation. The Jasper Creek Formation is mostly shale; however, the Devils Den Limestone Member crops out at the top of the formation in Jack County.

The Winchell Limestone overlies the Wolf Mountain Shale and crops out in the extreme south-central part of the county. The formation is a thin-bedded, hard limestone interbedded with calcareous shale.

The surface exposure of the Placid Shale in Jack County is at the southern county line in the

southwestern part of the county and extends northeastward to about 5 miles east of the Bartons Chapel community. It is in this vicinity that the formation is stratigraphically delineated from the Ventioner Formation outcrop. The Placid Shale is interbedded with sandstone lentils and a thin limestone strata near the top of the formation.

The Ventioner Formation outcrop in Jack County is delineated from the Placid Shale to the eastern county line *(3, 4)*. The formation is comprised of sandstone, shale, siltstone, and limestone strata.

The Ranger Limestone crops out in two general areas in Jack County. One area is in the extreme southwestern part of the county, and the other is about 3 miles northeast of the Bartons Chapel community, where it extends northeastward to the county line. Incisement, effected by erosion from Carrol Creek and its northward-flowing tributaries, has dissected the Ranger Limestone and exposed part of the underlying Ventioner Formation. The Ranger Limestone outcrop in the southwestern portion of the county is a single limestone stratum. The outcrop to the northeast is comprised of two limestone strata separated by a shale bed.

The Colony Creek Shale is the topmost formation of the Canyon Group in Jack County. Its outcrop extends in a continuous band from the southwestern corner to the northeastern part of the county. This shale formation also contains sandstone, conglomerate, and limestone strata.

Soils of the Exray-Truce-Bonti, Shatruce, Hensley-Palopinto, Anocon-Thurber, and Leeray general soil map units developed over the Canyon Group formations.

Cisco Group. The Cisco Group in Jack County is comprised of the older Graham Formation-Thrifty Formation and the overlying Markley Formation.

The Graham Formation-Thrifty Formation members, from oldest to youngest, are the Jacksboro Limestone, Gonzales Creek Member (sandstone, shale, and mudstone), Bunger Limestone, Lower Gunsight Limestone, Avis Sandstone, and Blach Ranch Limestone. Several sand and gravel channel deposits are between and within these members that have not yet been named *(3, 4)*.

The Markley Formation has alternating layers of argillaceous sandstone, shale, thin erosion-resistant limestone, and several interbedded, thin subbituminous coal beds. The base of the Markley Formation is conglomerate and coarse-grained sandstone. Unnamed Pennsylvanian fluvial and deltaic deposits are mapped separately on the Markley Formation.

Soils in the Exray-Truce-Bonti, Shatruce, Hensley-Palopinto, and Bluegrove-Kamay general soil map units developed over the Cisco Group formations.

Cretaceous Strata

Cretaceous-age Trinity Group formations overlie Canyon Group formations in the southeastern part of Jack County and Canyon Group and Cisco Group formations in the northeastern corner of the county *(3, 4)*. The Trinity Group in Jack County is part of the northwestern extremity of Lower Cretaceous outcrops. Geologic erosion has removed much of the upper portions of the Antlers Sand and the Paluxy Sand.

Cretaceous strata in Jack County generally have a southwest-northeasterly strike. In contrast to Pennsylvanian strata, Cretaceous strata dip to the southeast at about 20 feet per mile. Total thickness varies from a thin veneer to about 200 feet.

Trinity Group. The Trinity Group outcrops in Jack County are, from oldest to youngest, the Antlers Sand, the Twin Mountains Formation, the Glen Rose Limestone, and the Paluxy Sand.

The Antlers Sand is the lateral equivalent of the Twin Mountains Formation and Paluxy Sand and occurs north of the up-dip limit of the Glen Rose Limestone. The Antlers Sand outcrop in Jack County is a basal conglomerate in the extreme northeastern corner of the county. Normally, the basal conglomerate is overlain by poorly consolidated, massive, cross-bedded, fine- to coarse-grained sand. Erosion, however, has removed the poorly consolidated sand, and the remaining outcrop is generally hard, well indurated, nonargillaceous strata comprised mostly of pebble-sized chert and milky quartz clasts in a silica matrix.

Soils in the Exray-Truce-Bonti general soil map unit, in addition to being over Pennsylvanian strata, are also over the Antlers Sand. A limited Antlers Sand outcrop area and well indurated conglomeratic lithology, resembling Pennsylvanian-age nonargillaceous parent material, are principle factors for these soils being over Cretaceous-age strata.

The Twin Mountains Formation in Jack County consists of randomly bedded sandstone, conglomerate, siltstone, and claystone. The sandstone is poorly consolidated and is mostly in the lower part of the formation. The conglomerate is massive with clasts of chert, milky quartz, and limestone fragments.

Soils in the Duffau-Windthorst-Keeter general soil map unit developed over the Twin Mountains Formation.

The Twin Mountains Formation and the Paluxy Sand are separated by the Glen Rose Limestone in

the southeastern part of the county. The Glen Rose Limestone is primarily argillaceous, locally sandy limestone interbedded with claystone and siltstone.

Aledo soils within the Duffau-Windthorst-Keeter general soil map unit are typically over the Glen Rose Limestone in Jack County.

The Paluxy Sand is comprised of poorly consolidated, fine-grained sandstone interbedded with friable siltstone and claystone. The upper part of the Paluxy Sand does not occur in Jack County because of geologic erosion and its location in the survey area, on the western fringes of the regional outcrop.

Soils in the Duffau-Windthorst-Keeter general soil map unit developed over the Paluxy Sand.

Quaternary Sediments

Quaternary sediments in Jack County are almost exclusively Holocene flood plain deposits associated with present-day stream channel locations. Two small Pleistocene terraces are above the West Fork of the Trinity River near the eastern county line *(3, 4)*. The Holocene fluvial deposits are derived from older Pleistocene sediments and from Permian and Pennsylvanian rocks. These sediments are dominantly fine sand, silt, clay, and gravel.

Soils of the Gowan-Westfork general soil map unit developed on terrace and flood plain deposits of the West Fork of the Trinity River, West Keechi Creek, and their tributaries.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range

plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep soils, 20 to 40 inches; shallow soils, 10 to 20 inches; and very shallow soils, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The inclined surface at the base of a hill.
Forb. Any herbaceous plant not a grass or a sedge.
Fragile (in tables). A soil that is easily damaged by use or disturbance.
Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.
Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.
Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.
Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.
Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.
Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.
Ground water. Water filling all the unblocked pores of the material below the water table.
Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.
High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.
Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.
Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting

chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Orogenic. The process of mountain formation.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as *excellent, good, fair,* or *poor* on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannahs, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment

mounted on a tractor with a 200-300 draw bar horsepower rating.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments ranging from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.—Temperature and Precipitation

(Recorded in the period 1951-87 at Jacksboro, Texas)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temp. higher than--	Minimum temp. lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January--	57.3	31.9	44.6	82	7	71	1.27	0.17	2.11	3	0.7
February-	62.1	36.2	49.2	86	11	117	1.47	0.59	2.20	4	1.2
March----	70.2	43.6	56.9	92	19	269	1.92	0.63	2.97	4	0.4
April----	78.9	53.4	66.2	95	32	486	2.99	1.12	4.54	5	0.0
May------	84.8	61.0	72.9	98	42	710	4.37	2.33	6.14	6	0.0
June-----	92.0	68.8	80.4	103	53	912	2.70	0.88	4.19	4	0.0
July-----	96.6	73.1	84.9	106	61	1,082	2.33	0.65	3.67	3	0.0
August---	96.9	72.2	84.6	106	61	1,073	2.00	0.47	3.21	3	0.0
September	89.5	65.3	77.4	103	45	822	3.12	0.94	4.90	4	0.0
October--	79.9	54.7	67.3	96	36	536	3.41	0.88	5.44	4	0.0
November-	67.6	43.1	55.4	86	21	196	1.94	0.56	3.06	4	0.0
December-	60.0	35.0	47.5	82	12	87	1.43	0.36	2.30	3	0.1
Yearly:											
Average	78.0	53.2	---	---	---	---	---	---	---	---	---
Extreme	110	5	---	108	6	---	---	---	---	---	---
Total--	---	---	---	---	---	6,361	28.95	21.96	34.98	47	2.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.—Freeze Dates in Spring and Fall

(Recorded in the period 1951-87 at Jacksboro, Texas)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 16	Mar. 28	Apr. 10
2 years in 10 later than--	Mar. 9	Mar. 22	Apr. 4
5 years in 10 later than--	Feb. 24	Mar. 10	Mar. 23
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 15	Nov. 5	Oct. 30
2 years in 10 earlier than--	Nov. 22	Nov. 12	Nov. 3
5 years in 10 earlier than--	Dec. 6	Nov. 26	Nov. 12

Table 3.—Growing Season

(Recorded for the period 1951-87 at Jacksboro, Texas)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	257	231	212
8 years in 10	267	241	219
5 years in 10	285	260	233
2 years in 10	303	279	247
1 year in 10	312	289	254

Table 4.—Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AdB	Aledo clay loam, 1 to 3 percent slopes	5,011	0.9
AnB	Anocon loam, 1 to 3 percent slopes	16,894	2.9
BaC	Bastsil fine sandy loam, 1 to 5 percent slopes	23,626	4.0
BgB	Bluegrove loam, 1 to 3 percent slopes	17,222	2.9
BnB	Bonti fine sandy loam, 1 to 3 percent slopes	43,003	7.3
Bo	Bosque clay loam, occasionally flooded	2,914	0.5
ChC	Chaney loamy fine sand, 1 to 5 percent slopes	10,134	1.7
CoD	Cona fine sandy loam, 3 to 8 percent slopes, stony	7,038	1.2
DAM	Dams	177	*
DfC	Duffau very fine sandy loam, 1 to 5 percent slopes	5,529	0.9
DgC	Duffau-Gullied land complex, 1 to 5 percent slopes	4,481	0.8
EdD	Exray-Darnell complex, 1 to 8 percent slopes, very stony	73,895	12.5
Go	Gowen loam, occasionally flooded	19,141	3.2
Gw	Gowen loam, frequently flooded	13,281	2.3
HaA	Hassee loam, 0 to 1 percent slopes	5,164	0.9
HeB	Hensley loam, 1 to 3 percent slopes	4,504	0.8
HnB	Hensley loam, 1 to 3 percent slopes, extremely stony	15,643	2.7
JaB	Jacksboro fine sandy loam, 1 to 3 percent slopes	3,284	0.6
KaB	Kamay loam, 1 to 3 percent slopes	4,832	0.8
KtC	Keeter very fine sandy loam, 1 to 6 percent slopes	3,077	0.5
KtC2	Keeter very fine sandy loam, 2 to 6 percent slopes, eroded	1,074	0.2
LDF	Landfill	33	*
LeA	Leeray clay, 0 to 1 percent slopes	4,153	0.7
LeB	Leeray clay, 1 to 3 percent slopes	2,690	0.5
MwB	Minwells fine sandy loam, 1 to 3 percent slopes	1,237	0.2
OwE	Owens clay, 5 to 25 percent slopes, very stony	19,368	3.3
PaB	Palopinto loam, 1 to 4 percent slopes, extremely stony	13,936	2.4
Pt	Pits, limestone	186	*
Pu	Pulexas fine sandy loam, occasionally flooded	12,591	2.1
Px	Pulexas fine sandy loam, frequently flooded	2,855	0.5
RwB	Rowden loam, 0 to 2 percent slopes	18,545	3.1
SdB	Selden loamy fine sand, 1 to 3 percent slopes	1,125	0.2
SeC	Set clay, 3 to 5 percent slopes	14,851	2.5
SeE	Set-Palopinto complex, 8 to 30 percent slopes, very stony	12,336	2.1
ShF	Shatruce gravelly fine sandy loam, 8 to 30 percent slopes, very stony	24,816	4.2
ShG	Shatruce gravelly fine sandy loam, 12 to 50 percent slopes, extremely bouldery	46,095	7.8
StC	Stephenville fine sandy loam, 1 to 5 percent slopes	11,991	2.0
ThA	Thurber clay loam, 0 to 2 percent slopes	31,002	5.3
TrA	Treadway silty clay loam, 0 to 2 percent slopes	1,178	0.2
TuC	Truce fine sandy loam, 1 to 5 percent slopes	61,242	10.4
VrC	Vernon clay, 3 to 8 percent slopes	819	0.1
W	Water	3,582	0.6
Wf	Westfork silty clay, frequently flooded	10,482	1.8
WhC	Windthorst fine sandy loam, 1 to 5 percent slopes	9,178	1.6
WnB	Winters loam, 1 to 3 percent slopes	2,888	0.5
WsC	Wise loam, 3 to 5 percent slopes	2,029	0.3
	Total	589,132	100.0

* Less than 0.1 percent.

Table 5.—Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Wheat	Grain sorghum	Sorghum hay	Small grains grazeout	Improved bermudagrass
		Bu	Bu	Tons	AUM*	AUM*
AdB—Aledo	VIs	---	---	---	---	---
AnB—Anocon	IIe	23	40	4.5	2.5	6.0
BaC—Bastsil	IIIe	40	65	4.5	3.0	6.0
BgB—Bluegrove	IIIe	25	30	4.0	2.3	3.5
BnB—Bonti	IIIe	25	35	3.8	2.3	3.5
Bo—Bosque	IIw	40	65	5.5	3.0	7.0
ChC—Chaney	IIIe	20	35	4.0	2.5	6.0
CoD—Cona	VIs	---	---	---	---	---
DAM**. Dams						
DfC—Duffau	IIIe	35	40	4.0	2.5	6.0
DgC**:						
Duffau	VIe	---	---	---	---	4.0
Gullied land	VIIe	---	---	---	---	---
EdD**:						
Exray	VIs	---	---	---	---	---
Darnell	VIIs	---	---	---	---	---
Go—Gowen	IIw	35	65	5.3	3.0	7.0
Gw—Gowen	Vw	---	---	---	---	6.0
HaA—Hassee	IIIw	20	40	3.2	2.0	5.0
HeB—Hensley	IVs	20	25	2.5	2.0	3.5

See footnotes at end of table.

Table 5.—Land Capability and Yields per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Wheat	Grain sorghum	Sorghum hay	Small grains grazeout	Improved bermudagrass
		Bu	Bu	Tons	AUM*	AUM*
HnB—Hensley	VIs	---	---	---	---	---
JaB—Jacksboro	VIs	---	---	---	---	---
KaB—Kamay	IIIe	23	28	4.0	2.6	4.0
KtC—Keeter	IVe	---	---	3.0	2.3	4.0
KtC2—Keeter	IVe	---	---	---	---	3.5
LDF**. Landfill						
LeA—Leeray	IIs	28	45	4.5	2.5	4.0
LeB—Leeray	IIe	28	45	4.3	2.5	4.0
MwB—Minwells	IIe	25	40	3.5	2.8	5.0
OwE—Owens	VIIs	---	---	---	---	---
PaB—Palopinto	VIs	---	---	---	---	---
Pt**—Pits	VIIIs	---	---	---	---	---
Pu—Pulexas	IIw	30	62	5.0	3.0	7.0
Px—Pulexas	Vw	---	---	---	---	7.0
RwB—Rowden	IIIe	23	40	3.5	2.5	4.0
SdB—Selden	IIIe	20	40	---	---	5.5
SeC—Set	IIIe	25	---	3.5	2.5	3.5
SeE**:						
Set	VIIs	---	---	---	---	---
Palopinto	VIIs	---	---	---	---	---
ShF, ShG—Shatruce	VIIs	---	---	---	---	---

See footnotes at end of table.

Table 5.—Land Capability and Yields per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Wheat	Grain sorghum	Sorghum hay	Small grains grazeout	Improved bermudagrass
		Bu	Bu	Tons	AUM*	AUM*
StC—Stephenville	IIIe	25	30	3.0	2.5	3.5
ThA—Thurber	IIIe	20	30	3.2	2.3	3.5
TrA—Treadway	VIs	---	---	---	---	---
TuC—Truce	IVe	15	30	3.0	2.5	3.5
VrC—Vernon	VIe	---	---	---	---	---
W**. Water						
Wf—Westfork	Vw	---	---	---	---	---
WhC—Windthorst	IIIe	20	35	3.5	2.5	4.5
WnB—Winters	IIe	25	50	4.0	2.7	5.0
WsC—Wise	IVe	---	---	---	---	4.0

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

Table 6.—Rangeland Productivity

(Only the map units that support rangeland vegetation suitable for grazing are listed)

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
AdB---------- Aledo	Shallow----------	3,000	2,000	1,800
AnB---------- Anocon	Loamy Prairie----------	7,000	5,000	3,500
BaC---------- Bastsil	Sandy Loam----------	6,500	5,000	3,500
BgB---------- Bluegrove	Tight Sandy Loam---------	3,500	2,700	2,000
BnB---------- Bonti	Sandy Loam----------	6,000	3,500	3,000
Bo---------- Bosque	Loamy Bottomland---------	6,500	5,000	3,500
ChC---------- Chaney	Loamy Sand----------	4,500	4,000	3,000
CoD---------- Cona	Sandstone Hill----------	4,000	3,000	2,000
DAM*. Dams				
DfC---------- Duffau	Sandy Loam----------	5,500	4,500	3,000
DgC*: Duffau----------	Sandy Loam----------	5,500	4,500	3,000
Gullied land.				
EdD*: Exray----------	Sandstone Hill----------	6,000	4,000	2,500
Darnell---------	Sandstone Hill----------	3,200	2,100	1,400
Go, Gw---------- Gowen	Loamy Bottomland---------	8,000	5,500	4,000
HaA---------- Hassee	Claypan Prairie----------	4,000	3,000	2,000
HeB, HnB--------- Hensley	Redland----------	4,500	3,500	2,500
JaB---------- Jacksboro	Sandstone Hill----------	5,000	3,000	1,500
KaB---------- Kamay	Claypan Prairie----------	2,700	2,100	1,500
KtC, KtC2-------- Keeter	Tight Sandy Loam---------	4,500	3,500	2,000

See footnote at end of table.

Table 6.—Rangeland Productivity—Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
LDF*. Landfill				
LeA, LeB—Leeray	Clayey Upland	4,500	3,500	2,500
MwB—Minwells	Sandy Loam	4,000	3,000	2,000
OwE—Owens	Rocky Hill	1,700	1,200	900
PaB—Palopinto	Low Stony Hill	3,500	2,500	1,000
Pt*. Pits				
Pu, Px—Pulexas	Loamy Bottomland	6,500	5,000	3,500
RwB—Rowden	Clay Loam	4,500	3,500	2,500
SdB—Selden	Loamy Sand	5,000	4,200	3,500
SeC—Set	Clay Slopes	4,500	3,500	2,500
SeE*:				
Set	Clay Loam Slope	4,000	3,000	2,000
Palopinto	Steep Rocky	3,000	2,500	1,000
ShF—Shatruce	Sandstone Hill	5,000	3,000	1,500
ShG—Shatruce	Bouldery Hill	3,000	1,500	700
StC—Stephenville	Sandy Loam	4,500	3,300	2,500
ThA—Thurber	Claypan Prairie	3,500	3,000	2,000
TrA—Treadway	Clay Flat	2,000	1,000	600
TuC—Truce	Tight Sandy Loam	4,000	3,000	2,000
VrC—Vernon	Shallow Clay	2,500	1,700	1,000
W*. Water				
Wf—Westfork	Clayey Bottomland	4,500	3,500	2,500

See footnote at end of table.

Table 6.—Rangeland Productivity—Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
WhC—Windthorst	Sandy Loam	6,000	4,500	3,000
WnB—Winters	Clay Loam	2,500	2,200	1,200
WsC—Wise	Clay Loam	6,000	4,500	3,000

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 7.—Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AdB Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
AnB Anocon	Slight	Slight	Moderate: slope.	Slight	Slight.
BaC Bastsil	Slight	Slight	Moderate: slope.	Slight	Slight.
BgB Bluegrove	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
BnB Bonti	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
Bo Bosque	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
ChC Chaney	Slight	Slight	Moderate: slope.	Slight	Slight.
CoD Cona	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: large stones.
DAM*. Dams.					
DfC Duffau	Slight	Slight	Moderate: slope.	Slight	Slight.
DgC*: Duffau	Slight	Slight	Moderate: slope.	Slight	Slight.
Gullied land.					
EdD*: Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, depth to rock.	Slight	Severe: depth to rock.
Darnell	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, depth to rock.	Slight	Severe: depth to rock.
Go Gowen	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Gw Gowen	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

See footnote at end of table.

Table 7.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HaA—Hassee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
HeB—Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
HnB—Hensley	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Moderate: large stones.	Severe: large stones, depth to rock.
JaB—Jacksboro	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
KaB—Kamay	Slight	Slight	Moderate: slope.	Slight	Slight.
KtC, KtC2—Keeter	Slight	Slight	Moderate: slope.	Slight	Slight.
LDF*. Landfill					
LeA—Leeray	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
LeB—Leeray	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
MwB—Minwells	Slight	Slight	Moderate: slope.	Slight	Slight.
OwE—Owens	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.	Severe: large stones, slope.
PaB—Palopinto	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, depth to rock.
Pt*. Pits					
Pu—Pulexas	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Px—Pulexas	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
RwB—Rowden	Slight	Slight	Moderate: small stones.	Slight	Moderate: depth to rock.
SdB—Selden	Slight	Slight	Moderate: slope.	Slight	Slight.
SeC—Set	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

Table 7.—Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SeE*:					
Set	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Palopinto	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Slight	Severe: depth to rock.
ShF	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: slope.
ShG	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
StC	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: large stones, depth to rock.
ThA	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Moderate: droughty.
TrA	Moderate: percs slowly, excess salt.	Moderate: excess salt, percs slowly.	Moderate: percs slowly, excess salt.	Slight	Moderate: excess salt, droughty.
TuC	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VrC	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Slight	Severe: too clayey.
W*.					
Water					
Wf	Severe: flooding.	Moderate: flooding, too clayey.	Severe: flooding.	Moderate: too clayey, flooding.	Severe: flooding, too clayey.
WhC	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
WnB	Slight	Slight	Moderate: slope.	Slight	Slight.
WsC	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 8.—Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AdB---------- Aledo	Poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
AnB---------- Anocon	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
BaC---------- Bastsil	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
BgB---------- Bluegrove	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
BnB---------- Bonti	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Bo---------- Bosque	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
ChC---------- Chaney	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
CoD---------- Cona	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Fair.
DAM*. Dams									
DfC---------- Duffau	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
DgC*:									
Duffau----------	Poor	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
Gullied land------	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
EdD*:									
Exray----------	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Darnell----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Go---------- Gowen	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

Table 8.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Gw---- Gowen	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
HaA---- Hassee	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair.
HeB, HnB---- Hensley	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
JaB---- Jacksboro	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
KaB---- Kamay	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
KtC---- Keeter	Poor	Good	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
KtC2---- Keeter	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair.
LDF*. Landfill									
LeA, LeB---- Leeray	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
MwB---- Minwells	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
OwE---- Owens	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
PaB---- Palopinto	Poor	Poor	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Pt*---- Pits	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Pu---- Pulexas	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Px---- Pulexas	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.

See footnote at end of table.

Table 8.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
RwB---------- Rowden	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
SdB---------- Selden	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
SeC---------- Set	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
SeE*:									
Set----------	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Palopinto---------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
ShF, ShG---------- Shatruce	Very poor	Very poor	Good	Good	Very poor	Very poor	Very poor	Very poor	Good.
StC---------- Stephenville	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
ThA---------- Thurber	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
TrA---------- Treadway	Poor	Poor	Poor	Poor	Very poor	Poor	Poor	Very poor	Poor.
TuC---------- Truce	Fair	Good	Good	Good	Poor	Very poor	Fair	Very poor	Good.
VrC---------- Vernon	Fair	Fair	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
W*. Water									
Wf---------- Westfork	Fair	Fair	Poor	Fair	Poor	Poor	Fair	Poor	Poor.
WhC---------- Windthorst	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
WnB---------- Winters	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.

See footnote at end of table.

Table 8.—Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
WsC---------- Wise	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 9.—Building Site Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AdB Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
AnB Anocon	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BaC Bastsil	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
BgB Bluegrove	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: depth to rock.
BnB Bonti	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: depth to rock.
Bo Bosque	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
ChC Chaney	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CoD Cona	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: large stones.
DAM*. Dams						
DfC Duffau	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
DgC*: Duffau	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
Gullied land.						

See footnote at end of table.

Table 9.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EdD*:						
Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Darnell	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
Go	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Gw	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
HaA	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
HeB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
HnB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: large stones, depth to rock.
JaB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
KaB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
KtC	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
KtC2	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
LDF*.						
Landfill						

See footnote at end of table.

Table 9.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
LeA, LeB Leeray	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
MwB Minwells	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
OwE Owens	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: large stones, slope.
PaB Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, low strength.	Severe: large stones, depth to rock.
Pt*. Pits						
Pu Pulexas	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Px Pulexas	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
RwB Rowden	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: depth to rock.
SdB Selden	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
SeC Set	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: too clayey.
SeE*: Set	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, low strength.	Severe: depth to rock.

See footnote at end of table.

Table 9.—Building Site Development—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ShF, ShG---------- Shatruce	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
StC---------- Stephenville	Moderate: depth to rock, dense layer.	Slight---------	Moderate: depth to rock.	Slight---------	Slight---------	Moderate: large stones, depth to rock.
ThA---------- Thurber	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
TrA---------- Treadway	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: excess salt, droughty.
TuC---------- Truce	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
VrC---------- Vernon	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
W*. Water						
Wf---------- Westfork	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.
WhC---------- Windthorst	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
WnB---------- Winters	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
WsC---------- Wise	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 10.—Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AdB Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones.
AnB Anocon	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
BaC Bastsil	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BgB Bluegrove	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey.
BnB Bonti	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey.
Bo Bosque	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey, thin layer.
ChC Chaney	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CoD Cona	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
DAM*. Dams					
DfC Duffau	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

Table 10.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DgC*:					
Duffau	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Gullied land.					
EdD*:					
Exray	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, large stones.
Darnell	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
Go, Gw Gowen	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HaA Hassee	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
HeB, HnB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
JaB Jacksboro	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, small stones.
KaB Kamay	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KtC, KtC2 Keeter	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too sandy.	Slight	Fair: too sandy.
LDF*. Landfill					
LeA Leeray	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

Table 10.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LeB---------- Leeray	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
MwB---------- Minwells	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Slight----------	Poor: thin layer.
OwE---------- Owens	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
PaB---------- Palopinto	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, hard to pack, large stones.
Pt*. Pits					
Pu, Px---------- Pulexas	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
RwB---------- Rowden	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
SdB---------- Selden	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
SeC---------- Set	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
SeE*:					
Set----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Palopinto----------	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, hard to pack, large stones.

See footnote at end of table.

Table 10.—Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ShF, ShG---------- Shatruce	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
StC---------- Stephenville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
ThA---------- Thurber	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
TrA---------- Treadway	Severe: percs slowly.	Slight----------	Slight----------	Slight----------	Poor: hard to pack.
TuC---------- Truce	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
VrC---------- Vernon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
W*. Water					
Wf---------- Westfork	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
WhC---------- Windthorst	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
WnB---------- Winters	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
WsC---------- Wise	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 11.—Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AdB Aledo	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
AnB Anocon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BaC Bastsil	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BgB Bluegrove	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BnB Bonti	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Bo Bosque	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
ChC Chaney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
CoD Cona	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
DAM*. Dams				
DfC Duffau	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DgC*: Duffau	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Gullied land.				
EdD*: Exray	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Darnell	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, area reclaim, small stones.
Go, Gw Gowen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

Table 11.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
HaA—Hassee	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
HeB, HnB—Hensley	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
JaB—Jacksboro	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
KaB—Kamay	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KtC, KtC2—Keeter	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
LDF*. Landfill				
LeA, LeB—Leeray	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MwB—Minwells	Good	Probable	Probable	Poor: too clayey.
OwE—Owens	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
PaB—Palopinto	Poor: depth to rock, low strength, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.
Pt*. Pits				
Pu, Px—Pulexas	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
RwB—Rowden	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
SdB—Selden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SeC—Set	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

Table 11.—Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
SeE*:				
Set	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Palopinto	Poor: depth to rock, low strength, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.
ShF Shatruce	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
ShG Shatruce	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
StC Stephenville	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, area reclaim.
ThA Thurber	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TrA Treadway	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
TuC Truce	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
VrC Vernon	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
W*. Water				
Wf Westfork	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WhC Windthorst	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WnB Winters	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WsC Wise	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 12.—Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
AdB—Aledo	Severe: depth to rock.	Severe: thin layer.	Droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
AnB—Anocon	Slight	Hard to pack	Favorable	Favorable	Favorable.
BaC—Bastsil	Moderate: seepage.	Moderate: piping.	Slope, soil blowing.	Soil blowing	Favorable.
BgB—Bluegrove	Moderate: depth to rock.	Severe: thin layer.	Depth to rock	Depth to rock, erodes easily.	Erodes easily, depth to rock.
BnB—Bonti	Moderate: depth to rock.	Severe: thin layer.	Soil blowing	Depth to rock, erodes easily, soil blowing.	Erodes easily, depth to rock.
Bo—Bosque	Moderate: seepage.	Severe: piping.	Flooding	Favorable	Favorable.
ChC—Chaney	Slight	Severe: hard to pack.	Slope, fast intake, soil blowing.	Soil blowing, percs slowly.	Rooting depth, percs slowly.
CoD—Cona	Slight	Severe: hard to pack.	Slope, percs slowly.	Large stones	Large stones, percs slowly.
DAM*. Dams					
DfC—Duffau	Moderate: seepage.	Slight	Slope, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
DgC*: Duffau	Moderate: seepage.	Slight	Slope, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
Gullied land.					
EdD*: Exray	Severe: depth to rock.	Severe: thin layer.	Slope, droughty.	Depth to rock	Droughty, depth to rock.
Darnell	Severe: depth to rock.	Severe: piping.	Slope, soil blowing, depth to rock.	Depth to rock	Depth to rock.
Go, Gw—Gowen	Moderate: seepage.	Moderate: piping.	Flooding	Favorable	Favorable.
HaA—Hassee	Slight	Severe: hard to pack, wetness.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

Table 12.—Water Management—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
HeB—Hensley	Severe: depth to rock.	Severe: thin layer.	Droughty, percs slowly.	Depth to rock, erodes easily, percs slowly.	Erodes easily, droughty, depth to rock.
HnB—Hensley	Severe: depth to rock.	Severe: thin layer.	Droughty, percs slowly.	Large stones, depth to rock, erodes easily.	Large stones, erodes easily, droughty.
JaB—Jacksboro	Severe: depth to rock.	Severe: thin layer.	Droughty, soil blowing, depth to rock.	Depth to rock, soil blowing.	Droughty, depth to rock.
KaB—Kamay	Slight	Moderate: hard to pack, excess salt.	Percs slowly, rooting depth, erodes easily.	Erodes easily, percs slowly.	Erodes easily, rooting depth, percs slowly.
KtC, KtC2—Keeter	Moderate: seepage.	Severe: piping.	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
LDF*. Landfill					
LeA, LeB—Leeray	Slight	Severe: hard to pack.	Slow intake, percs slowly.	Percs slowly	Percs slowly.
MwB—Minwells	Severe: seepage.	Moderate: thin layer, piping.	Soil blowing, percs slowly.	Soil blowing	Percs slowly.
OwE—Owens	Slight	Moderate: hard to pack.	Slope, droughty.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
PaB—Palopinto	Severe: depth to rock.	Severe: large stones.	Large stones, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
Pt*. Pits					
Pu, Px—Pulexas	Severe: seepage.	Severe: piping.	Soil blowing, flooding.	Soil blowing	Favorable.
RwB—Rowden	Moderate: depth to rock.	Severe: thin layer.	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
SdB—Selden	Slight	Moderate: piping.	Fast intake, soil blowing.	Soil blowing	Favorable.
SeC—Set	Moderate: slope.	Moderate: hard to pack.	Slope, slow intake, percs slowly.	Percs slowly	Percs slowly.
SeE*: Set	Severe: slope.	Moderate: hard to pack.	Slope, slow intake.	Slope, percs slowly.	Slope, percs slowly.
Palopinto	Severe: depth to rock.	Severe: large stones.	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.

See footnote at end of table.

Table 12.—Water Management—Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
ShF, ShG---- Shatruce	Severe: slope.	Slight----	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
StC---- Stephenville	Moderate: seepage, depth to rock, slope.	Severe: piping.	Slope, soil blowing.	Depth to rock, soil blowing.	Depth to rock, rooting depth.
ThA---- Thurber	Slight----	Severe: hard to pack.	Droughty, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, droughty, percs slowly.
TrA---- Treadway	Slight----	Moderate: hard to pack, excess salt.	Droughty, percs slowly.	Erodes easily, percs slowly.	Too arid, excess salt, erodes easily.
TuC---- Truce	Slight----	Moderate: hard to pack.	Slope, droughty, soil blowing.	Erodes easily, soil blowing, percs slowly.	Erodes easily, droughty, percs slowly.
VrC---- Vernon	Moderate: slope.	Moderate: hard to pack.	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
W*. Water					
Wf---- Westfork	Slight----	Moderate: hard to pack.	Slow intake, percs slowly, flooding.	Percs slowly---	Percs slowly.
WhC---- Windthorst	Slight----	Moderate: hard to pack.	Slope, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
WnB---- Winters	Moderate: seepage.	Moderate: hard to pack.	Favorable------	Favorable------	Favorable.
WsC---- Wise	Severe: seepage.	Severe: piping.	Slope, droughty, erodes easily.	Erodes easily	Erodes easily, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 13.—Engineering Index Properties

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
AdB---------- Aledo	0-6	Clay loam--------	CL	A-7, A-6, A-4	0-5	85-100	85-100	80-95	60-80	27-42	8-22
	6-15	Very gravelly clay loam, very gravelly loam.	GC, SC	A-2-4, A-2-6	0-25	35-65	30-50	25-50	15-35	27-40	8-20
	15-35	Unweathered bedrock	---	---	---	---	---	---	---	---	---
AnB---------- Anocon	0-14	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-80	20-30	4-14
	14-45	Sandy clay, clay, clay loam.	CL, SC, CH	A-6, A-7	0	95-100	95-100	90-100	45-85	30-53	15-33
	45-68	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-4	0	90-100	90-100	85-100	40-85	25-48	8-31
BaC---------- Bastsil	0-10	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	95-100	95-100	75-100	36-70	<25	NP-7
	10-88	Loam, clay loam, sandy clay loam.	CL, SC	A-6, A-7-6	0	95-100	90-100	75-100	40-70	26-42	11-26
BgB---------- Bluegrove	0-5	Loam----------	CL, CL-ML	A-4, A-6	0	100	98-100	90-98	60-75	18-30	4-14
	5-28	Sandy clay, clay loam, clay.	CL, SC	A-6, A-7	0-5	95-100	95-100	80-100	45-80	28-50	11-30
	28-48	Weathered bedrock	---	---	---	---	---	---	---	---	---
BnB---------- Bonti	0-8	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4, A-2-4	0-5	90-100	90-100	70-100	25-70	<30	NP-10
	8-34	Clay, clay loam, sandy clay.	CL, SC	A-6, A-7	0-5	80-100	80-100	70-100	41-75	30-45	15-25
	34-54	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bo---------- Bosque	0-30	Clay loam--------	CL, CL-ML	A-4, A-6, A-7-6	0	100	96-100	90-100	56-85	23-45	7-25
	30-47	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-6, A-7-6, A-4	0	100	95-100	80-90	50-85	23-45	7-25
	47-80	Loam, clay loam, clay.	CL, CL-ML	A-4, A-6, A-7-6	0	98-100	95-100	85-100	65-94	23-49	7-29

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
ChC---------- Chaney	0-9	Loamy fine sand	SM, SP-SM	A-2-4, A-4, A-3	0	80-100	80-100	65-98	7-45	16-25	NP-5
	9-37	Clay, sandy clay	CL, CH, SC	A-6, A-7-6	0	90-100	90-100	90-100	43-85	39-60	24-42
	37-50	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6	0	90-100	90-100	80-100	45-85	25-55	11-40
	50-80	Shaly clay, sandy clay loam, sandy clay.	CL, CH, SC, SC-SM	A-6, A-7-6, A-2, A-4	0	90-100	90-100	80-100	25-85	25-60	6-40
CoD---------- Cona	0-7	Stony fine sandy loam.	SM, SC, SC-SM	A-2-4, A-4	5-20	85-100	80-100	65-75	25-49	15-25	2-8
	7-38	Sandy clay, clay	CL, CH	A-6, A-7	0-20	80-100	75-100	70-95	60-85	36-65	20-45
	38-60	Shaly clay, sandy clay.	CL, CH	A-7, A-6	0-10	80-100	75-100	65-95	60-85	36-65	22-45
DAM*. Dams											
DfC---------- Duffau	0-15	Very fine sandy loam.	SM, SC-SM, ML, CL-ML	A-4	0	95-100	95-100	80-100	36-65	16-28	NP-7
	15-72	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
	72-80	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, CL, CL-ML, SM	A-4, A-6	0	95-100	95-100	80-100	40-65	20-36	2-18
DgC*:											
Duffau----------	0-11	Very fine sandy loam.	SM, SC-SM, ML, CL-ML	A-4	0	95-100	95-100	80-100	36-65	16-28	NP-7
	11-65	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
	65-80	Sandy clay loam, fine sandy loam, very fine sandy loam.	SC, CL, CL-ML, SM	A-4, A-6	0	95-100	95-100	80-100	40-65	20-36	2-18
Gullied land.											

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EdD*:											
Exray	0-5	Very stony fine sandy loam.	SC-SM, SC	A-2-4, A-4	5-23	85-100	80-100	55-80	30-50	20-30	5-10
	5-17	Clay, sandy clay, clay loam.	CL, SC	A-6, A-7	0-5	85-100	80-100	80-100	48-80	30-45	15-25
	17-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
Darnell	0-4	Very stony fine sandy loam.	SM, SC-SM, ML, CL-ML	A-4, A-2	0-15	90-100	88-100	83-100	30-60	0-26	NP-7
	4-15	Fine sandy loam, loam, gravelly fine sandy loam.	SM, SC, ML, CL	A-4, A-2	0-10	70-100	70-100	60-100	25-60	15-30	NP-10
	15-35	Weathered bedrock	---	---	---	---	---	---	---	---	---
Go	0-28	Loam	CL	A-6	0	100	96-100	80-98	50-80	25-40	11-24
Gowen	28-80	Clay loam, loam, sandy clay loam.	CL	A-6, A-7-6	0	100	96-100	80-100	55-85	25-45	11-28
Gw	0-18	Loam	CL	A-6	0	100	96-100	80-98	50-80	25-40	11-24
Gowen	18-80	Clay loam, loam, sandy clay loam.	CL	A-6, A-7-6	0	100	96-100	80-100	55-85	25-45	11-28
HaA	0-14	Loam	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	20-35	8-16
Hassee	14-60	Clay, silty clay	CH, CL	A-7-6	0	95-100	95-100	95-100	75-95	41-62	24-41
	60-80	Clay, clay loam	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	70-95	35-52	20-35
HeB	0-5	Loam	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-85	20-35	5-16
Hensley	5-15	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-90	35-55	18-35
	15-35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HnB	0-6	Extremely stony loam.	CL, CL-ML	A-4, A-6	30-50	80-100	75-100	70-100	60-90	20-40	5-20
Hensley	6-16	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	65-95	35-55	18-35
	16-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
JaB---------- Jacksboro	0-4	Fine sandy loam	SM, SC-SM, SC	A-4	0-1	86-98	75-95	60-80	35-50	18-26	2-10
	4-11	Gravelly fine sandy loam, very gravelly fine sandy loam.	SC, GM, SC-SM, GC	A-1, A-2-6, A-2-4	0-5	30-75	25-70	20-60	15-35	16-33	3-17
	11-18	Very gravelly clay loam, very gravelly clay.	GC, SC	A-2-7, A-7-6	0-5	25-70	25-50	25-50	20-40	41-60	23-40
	18-25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
KaB---------- Kamay	0-10	Loam----------	CL, CL-ML	A-4, A-6	0	100	100	90-100	60-90	20-40	5-20
	10-68	Clay, clay loam	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-98	35-60	18-40
	68-85	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-98	35-60	18-40
KtC---------- Keeter	0-6	Very fine sandy loam.	SM, SC-SM, ML, CL-ML	A-4	0	98-100	95-100	95-100	42-71	18-30	NP-7
	6-17	Sandy clay, clay loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	66-96	35-49	16-28
	17-25	Clay loam, sandy clay loam, loam.	CL	A-4, A-6, A-7	0	95-100	95-100	90-100	66-96	28-44	8-22
	25-40	Very fine sandy loam, loam.	CL-ML, ML, CL	A-4	0	95-100	95-100	85-100	50-79	17-30	1-10
	40-80	Loamy fine sand, sand.	SM, SC-SM SP-SM	A-2-4, A-4, A-3	0	95-100	95-100	75-100	20-49	<25	NP-5
KtC2---------- Keeter	0-3	Very fine sandy loam.	SM, SC-SM, ML, CL-ML	A-4	0	98-100	95-100	95-100	42-71	18-30	NP-7
	3-15	Sandy clay, clay loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	66-96	35-49	16-28
	15-25	Clay loam, sandy clay loam, loam.	CL	A-4, A-6, A-7	0	95-100	95-100	90-100	66-96	28-44	8-22
	25-80	Loamy fine sand, sand.	SM, SC-SM SP-SM	A-2-4, A-4, A-3	0	95-100	95-100	75-100	20-49	<25	NP-5
LDF*. Landfill											

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
LeA---------- Leeray	0-6	Clay----------	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
	6-21	Clay, silty clay	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
	21-42	Clay, silty clay	CH	A-7-6	0-5	95-100	95-100	85-100	75-95	51-70	30-45
	42-80	Silty clay loam, clay, silty clay.	CH, CL	A-7-6	0-5	95-100	95-100	85-100	70-95	44-57	30-40
LeB---------- Leeray	0-10	Clay----------	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
	10-26	Clay, silty clay	CH, CL	A-7-6	0-5	97-100	96-100	85-100	75-95	45-65	30-42
	26-64	Clay, silty clay	CH	A-7-6	0-5	95-100	95-100	85-100	75-95	51-70	30-45
	64-80	Silty clay loam, clay, silty clay.	CH, CL	A-7-6	0-5	95-100	95-100	85-100	70-95	44-57	30-40
MwB---------- Minwells	0-10	Fine sandy loam	CL, CL-ML, SC-SM, SC	A-2, A-4, A-6	0	96-100	90-100	80-98	30-60	<30	NP-15
	10-35	Clay, clay loam, sandy clay.	CL	A-7-6, A-6	0	95-100	90-100	85-98	50-80	32-50	15-32
	35-45	Clay loam, sandy clay loam, gravelly sandy clay loam.	CL, SC	A-6, A-7-6, A-4	0	85-100	80-100	65-98	45-80	23-45	8-26
	45-60	Very gravelly sand, very gravelly sandy loam, gravelly sandy clay loam.	SC, GM, SP-SM, GP-GM	A-1, A-2	0-5	15-75	10-60	5-50	5-30	<44	NP-28
OwE---------- Owens	0-7	Very stony clay	CL, CH	A-7-6	15-35	80-100	75-100	70-100	65-95	45-60	22-32
	7-18	Clay, clay loam, silty clay.	CL, CH	A-7-6	0-10	80-100	80-100	80-100	75-95	45-60	22-33
	18-80	Shaly clay, clay	CL, CH	A-7-6	0-10	90-100	85-100	80-100	65-95	45-60	25-37
PaB---------- Palopinto	0-10	Extremely stony loam.	CH, CL	A-7-6, A-6	25-55	85-100	85-100	75-100	70-95	39-58	17-31
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pt*. Pits											

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Pu	0-50	Fine sandy loam	SM, ML	A-4	0	100	95-100	70-85	36-55	<30	NP-7
Pulexas	50-80	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	45-74	<30	NP-10
Px	0-37	Fine sandy loam	SM, ML	A-4	0	100	95-100	70-85	36-55	<30	NP-7
Pulexas	37-80	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	45-74	<30	NP-10
RwB	0-16	Loam	CL	A-6	0-5	90-100	75-100	70-100	50-75	28-40	11-21
Rowden	16-38	Clay, clay loam	CH, CL	A-7-6	0-5	85-100	75-100	75-100	60-80	41-60	20-35
	38-58	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SdB	0-14	Loamy fine sand	SP-SM, SM, SC-SM	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
Selden	14-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	85-100	36-65	28-47	12-28
SeC	0-14	Clay	CL, CH	A-7-6	0-5	95-100	95-100	80-100	75-95	41-60	20-36
Set	14-48	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	75-95	33-60	20-40
	48-80	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7-6	0	90-100	85-100	80-100	75-95	33-60	16-36
SeE*:											
Set	0-12	Stony silty clay	CL, CH	A-7-6	1-5	95-100	95-100	80-100	75-95	41-60	20-36
	12-42	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	80-100	75-95	33-60	20-40
	42-80	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7-6	0	90-100	85-100	80-100	75-95	33-60	16-36
Palopinto	0-6	Very stony clay loam.	CH, CL	A-7-6, A-6	10-25	85-100	85-100	75-100	70-95	39-58	17-31
	6-14	Extremely stony clay loam, extremely stony silty clay loam, extremely stony loam.	CH, CL	A-7-6, A-6	50-85	65-100	65-100	60-100	51-95	39-58	17-31
	14-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ShF---------- Shatruce	0-7	Very stony fine sandy loam.	SM, SC-SM	A-2-4, A-4	15-30	70-95	50-85	45-75	25-40	15-25	2-7
	7-32	Clay, sandy clay, clay loam.	CL	A-7-6, A-6	0-5	80-100	80-100	80-100	51-80	36-47	25-35
	32-80	Clay----------	CL	A-6, A-7-6	0-5	80-100	80-100	80-100	51-80	31-45	20-30
ShG---------- Shatruce	0-6	Extremely bouldery fine sandy loam.	SM, SC-SM	A-2-4, A-4	15-30	70-95	50-85	45-75	25-40	15-25	2-7
	6-25	Clay, sandy clay, clay loam.	CL	A-7-6, A-6	0-5	80-100	80-100	80-100	51-80	36-47	25-35
	25-80	Clay----------	CL	A-6, A-7-6	0-5	80-100	80-100	80-100	51-80	31-45	20-30
StC---------- Stephenville	0-8	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2, A-4	0-15	83-100	83-100	80-100	11-60	14-26	NP-7
	8-25	Fine sandy loam, sandy clay loam.	SC, CL, SC-SM, CL-ML	A-4, A-6	0	100	98-100	90-100	36-65	20-37	7-16
	25-45	Weathered bedrock	---	---	---	---	---	---	---	---	---
ThA---------- Thurber	0-6	Clay loam--------	CL	A-4, A-6	0	98-100	96-100	90-100	60-90	25-40	8-20
	6-50	Clay, clay loam	CL, CH	A-7-6, A-6	0	98-100	96-100	90-100	70-95	37-65	22-45
	50-80	Clay, clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	85-100	75-100	50-85	35-50	20-35
TrA---------- Treadway	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	96-100	80-98	37-50	15-26
	11-34	Clay----------	CH, CL	A-7	0	80-90	80-90	80-90	72-85	45-60	19-34
	34-60	Clay----------	CH, CL	A-7	0	80-90	80-90	80-90	72-85	45-60	19-34
TuC---------- Truce	0-6	Fine sandy loam	CL-ML, SC-SM, SM, SC	A-4	0	95-100	90-100	75-100	40-70	20-30	3-10
	6-43	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	90-100	90-100	75-100	55-85	35-52	18-32
	43-65	Very shaly clay, shaly clay.	CL, CH	A-6, A-7-6	0	88-100	85-100	75-100	60-95	30-52	15-32

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
VrC---------- Vernon	0-6	Clay----------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	6-34	Clay, silty clay	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-40
	34-60	Shaly clay, very shaly clay, extremely shaly clay.	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-96	30-60	15-38
W*. Water											
Wf---------- Westfork	0-21	Silty clay-------	CL, CH	A-7-6	0	100	100	98-100	95-100	41-55	24-35
	21-40	Silty clay loam, silty clay, clay.	CL, CH	A-7-6	0	100	100	98-100	95-100	41-55	24-35
	40-80	Silty clay loam, silty clay, clay.	CL, CH	A-7-6	0	100	100	95-100	90-100	41-55	24-35
WhC---------- Windthorst	0-5	Fine sandy loam	SM, SC-SM, CL-ML, ML	A-4	0	100	95-100	75-100	36-65	<28	NP-7
	5-44	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	60-89	35-53	20-35
	44-64	Sandy clay loam, sandy clay, clay loam.	CL	A-4, A-6, A-7-6	0	95-100	90-100	75-100	55-84	25-45	8-28
	64-80	Sandy clay loam, fine sandy loam, shaly clay.	SC, CL	A-4, A-6, A-7-6	0	90-100	90-100	75-100	45-74	25-45	8-28
WnB---------- Winters	0-8	Loam----------	CL, CL-ML	A-4, A-6	0	98-100	95-100	75-100	51-85	24-35	6-15
	8-64	Sandy clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	90-100	80-100	60-90	41-52	20-30
	64-80	Clay loam, sandy clay loam, sandy clay.	CL, CH	A-6, A-7-6	0	95-100	90-100	80-100	51-87	27-52	14-33

See footnote at end of table.

Table 13.—Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WsC----------	0-8	Loam----------	CL, CL-ML	A-6, A-4	0	95-100	95-100	85-100	75-95	17-40	5-22
Wise	8-26	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	95-100	85-100	75-95	17-40	5-22
	26-60	Stratified very fine sandy loam to shaly silty clay loam.	CL, CL-ML, SC, SC-SM	A-6, A-4	0	95-100	95-100	85-100	49-85	17-40	5-22

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 14.—Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm		K	T		Pct
AdB	0-6	20-35	1.15-1.45	0.6-2.0	0.12-0.18	7.9-8.4	0-2	Moderate	0.32	1	4L	1-3
Aledo	6-15	20-35	1.20-1.50	0.6-2.0	0.05-0.12	7.9-8.4	0-2	Low	0.10			
	15-35	---	---	0.6-2.0	---	---	---					
AnB	0-14	15-26	1.35-1.60	2.0-6.0	0.12-0.18	6.1-7.3	<2	Low	0.32	5	6	1-3
Anocon	14-45	35-50	1.30-1.60	0.2-0.6	0.12-0.15	6.1-7.8	<2	Moderate	0.32			
	45-68	25-40	1.30-1.60	0.2-0.6	0.12-0.15	6.6-8.4	<2	Moderate	0.32			
BaC	0-10	7-20	1.50-1.65	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low	0.24	5	3	<2
Bastsil	10-88	18-35	1.50-1.65	0.6-2.0	0.12-0.16	5.6-7.8	<2	Moderate	0.32			
BgB	0-5	15-25	1.35-1.50	0.6-2.0	0.14-0.19	5.6-7.3	0-2	Low	0.37	3	5	.5-3
Bluegrove	5-28	27-60	1.35-1.60	0.2-0.6	0.15-0.20	6.1-7.3	0-2	Moderate	0.32			
	28-48	---	---	0.2-2.0	---	---	---					
BnB	0-8	10-20	1.35-1.60	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	2	3	.1-2
Bonti	8-34	35-56	1.35-1.60	0.2-0.6	0.10-0.15	5.1-6.0	<2	Moderate	0.32			
	34-54	---	---	0.2-2.0	---	---	---					
Bo	0-30	27-35	1.20-1.40	0.6-2.0	0.15-0.20	7.9-8.4	0-2	Low	0.28	5	4L	1-4
Bosque	30-47	20-35	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	0-2	Low	0.28			
	47-80	20-45	1.20-1.40	0.6-2.0	0.11-0.18	7.9-8.4	0-2	Low	0.28			
ChC	0-9	5-15	1.78-1.87	2.0-6.0	0.05-0.10	6.1-7.3	0-2	Low	0.20	5	2	.1-1
Chaney	9-37	35-50	1.40-1.65	0.06-0.2	0.12-0.16	5.6-7.3	0-2	Moderate	0.28			
	37-50	20-45	1.54-1.82	0.06-0.2	0.15-0.18	5.6-8.4	0-2	Moderate	0.28			
	50-80	20-45	1.70-1.90	0.06-0.2	0.10-0.13	5.6-8.4	0-2	Moderate	0.28			
CoD	0-7	5-15	1.40-1.60	2.0-6.0	0.12-0.16	6.1-7.8	<2	Low	0.20	4	8	<2
Cona	7-38	35-50	1.25-1.45	0.2-0.6	0.12-0.16	5.1-6.0	<2	High	0.32			
	38-60	35-50	1.40-1.70	0.01-0.6	0.06-0.15	5.6-7.8	<2	High	0.32			
DAM*.												
Dams												
DfC	0-15	5-18	1.30-1.50	2.0-6.0	0.12-0.17	6.1-7.8	0-2	Low	0.49	5	3	<1
Duffau	15-72	20-35	1.35-1.60	0.6-2.0	0.12-0.19	6.1-7.3	0-2	Low	0.37			
	72-80	15-35	1.45-1.65	0.6-2.0	0.10-0.15	6.1-7.8	0-2	Low	0.43			

See footnote at end of table.

Table 14.—Physical and Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
DgC*:												
Duffau----------	0-11	5-18	1.30-1.50	2.0-6.0	0.12-0.17	6.1-7.8	0-2	Low-------	0.49	5	3	<1
	11-65	20-35	1.35-1.60	0.6-2.0	0.12-0.19	5.6-7.3	0-2	Low-------	0.37			
	65-80	15-35	1.45-1.65	0.6-2.0	0.10-0.15	6.1-7.8	0-2	Low-------	0.43			
Gullied land.												
EdD*:												
Exray-----------	0-5	7-20	1.40-1.60	0.6-2.0	0.07-0.12	6.1-7.3	<2	Low-------	0.15	1	8	.5-1
	5-17	35-50	1.40-1.60	0.2-0.6	0.12-0.20	5.6-6.5	<2	Moderate	0.32			
	17-20	---	---	0.2-2.0	---	---	---	----------	----			
Darnell---------	0-4	10-20	1.30-1.65	2.0-6.0	0.11-0.15	6.1-7.3	0-0	Low-------	0.15	2	3	.5-1
	4-15	10-25	1.40-1.70	2.0-6.0	0.12-0.16	5.6-7.3	0-0	Low-------	0.20			
	15-35	---	1.85-2.00	0.01-0.2	---	---	---	----------	----			
Go---------------	0-28	18-30	1.40-1.55	0.6-2.0	0.15-0.20	6.6-8.4	0-2	Moderate	0.28	5	5	1-4
Gowen	28-80	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.6-8.4	0-2	Moderate	0.28			
Gw---------------	0-18	18-30	1.40-1.55	0.6-2.0	0.15-0.20	6.6-8.4	0-2	Moderate	0.28	5	5	1-4
Gowen	18-80	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.6-8.4	0-2	Moderate	0.28			
HaA---------------	0-14	10-20	1.50-1.65	0.6-2.0	0.11-0.17	6.1-7.3	<2	Low-------	0.43	5	5	<2
Hassee	14-60	45-60	1.30-1.55	<0.06	0.12-0.18	6.1-8.4	<2	High------	0.32			
	60-80	35-60	1.30-1.55	<0.06	0.12-0.18	7.9-8.4	<2	High------	0.32			
HeB---------------	0-5	15-30	1.30-1.50	0.2-0.6	0.12-0.18	6.1-7.8	<2	Low-------	0.37	1	6	.5-2
Hensley	5-15	35-55	1.25-1.45	0.06-0.2	0.08-0.15	6.6-7.8	<2	Moderate	0.32			
	15-35	---	---	0.06-2.0	---	---	---	----------	----			
HnB---------------	0-6	15-30	1.35-1.55	0.2-0.6	0.08-0.16	6.1-7.8	0-2	Low-------	0.10	1	8	.5-2
Hensley	6-16	35-55	1.40-1.65	0.06-0.2	0.10-0.20	6.6-7.8	0-2	Moderate	0.43			
	16-40	---	---	0.06-2.0	---	---	---	----------	----			
JaB---------------	0-4	10-20	1.40-1.55	2.0-6.0	0.10-0.15	6.1-7.3	<2	Low-------	0.24	1	3	<1
Jacksboro	4-11	10-20	1.45-1.65	2.0-6.0	0.06-0.10	5.6-7.3	<2	Low-------	0.10			
	11-18	35-45	1.40-1.60	0.2-0.6	0.07-0.11	5.1-6.5	<2	Moderate	0.10			
	18-25	---	---	0.2-2.0	---	---	---	----------	----			
KaB---------------	0-10	15-25	1.40-1.60	0.6-2.0	0.10-0.16	6.1-7.3	0-2	Low-------	0.37	5	5	1-3
Kamay	10-68	35-50	1.40-1.60	0.06-0.2	0.10-0.16	6.6-8.4	4-8	High------	0.32			
	68-85	35-45	1.40-1.75	0.06-0.2	0.10-0.16	7.9-8.4	4-16	High------	0.32			

See footnote at end of table.

Table 14.—Physical and Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
KtC	0-6	4-15	1.40-1.60	0.6-2.0	0.12-0.17	6.1-7.3	<2	Low	0.43	5	3	<2
Keeter	6-17	27-40	1.40-1.60	0.2-0.6	0.11-0.16	5.1-6.5	<2	Moderate	0.32			
	17-25	15-35	1.45-1.65	0.2-0.6	0.11-0.16	5.1-6.5	<2	Moderate	0.32			
	25-40	4-18	1.45-1.65	0.6-2.0	0.10-0.15	5.6-7.3	<2	Low	0.43			
	40-80	4-10	1.45-1.65	0.6-2.0	0.08-0.11	6.6-7.8	<2	Low	0.37			
KtC2	0-3	4-15	1.40-1.60	0.6-2.0	0.12-0.17	6.1-7.3	<2	Low	0.43	5	3	<2
Keeter	3-15	27-40	1.40-1.60	0.2-0.6	0.11-0.16	5.1-6.5	<2	Moderate	0.32			
	15-25	15-35	1.45-1.65	0.2-0.6	0.11-0.16	5.6-7.3	<2	Moderate	0.32			
	25-80	4-10	1.45-1.65	0.6-2.0	0.08-0.11	6.6-7.8	<2	Low	0.37			
LDF*.												
Landfill												
LeA	0-6	40-60	1.10-1.40	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32	5	4	1-5
Leeray	6-21	40-60	1.10-1.40	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32			
	21-42	40-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	0-4	Very high	0.32			
	42-80	35-50	1.35-1.60	<0.06	0.10-0.15	7.9-8.4	4-16	High	0.32			
LeB	0-10	40-60	1.10-1.40	<0.06	0.12-0.18	7.4-7.8	0-2	Very high	0.32	5	4	1-5
Leeray	10-26	40-60	1.10-1.40	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32			
	26-64	40-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	0-4	Very high	0.32			
	64-80	35-50	1.35-1.60	<0.06	0.10-0.15	7.9-8.4	4-16	High	0.32			
MwB	0-10	10-20	1.40-1.55	2.0-6.0	0.10-0.15	6.1-7.3	<2	Low	0.24	5	3	.1-1
Minwells	10-35	35-45	1.35-1.60	0.06-0.2	0.11-0.16	6.1-7.3	<2	Moderate	0.32			
	35-45	20-35	1.35-1.60	0.2-0.6	0.10-0.16	7.4-8.4	<2	Moderate	0.32			
	45-60	3-25	1.35-1.60	2.0-6.0	0.01-0.09	6.6-8.4	<2	Low	0.15			
OwE	0-7	35-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	<2	Moderate	0.10	1	8	.5-2
Owens	7-18	35-60	1.45-1.65	<0.06	0.13-0.17	7.9-8.4	<4	High	0.32			
	18-80	35-60	1.70-2.00	<0.06	0.01-0.05	7.9-8.4	2-8	High	0.37			
PaB	0-10	18-35	1.25-1.45	0.6-2.0	0.10-0.15	6.1-8.4	0-2	Moderate	0.05	1	8	1-4
Palopinto	10-60	---	---	0.06-2.0	---	---	---		----			
Pt*.												
Pits												
Pu	0-50	7-18	1.30-1.55	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low	0.28	5	3	<2
Pulexas	50-80	8-18	1.30-1.50	2.0-6.0	0.11-0.15	6.1-8.4	<2	Low	0.28			
Px	0-37	7-18	1.30-1.55	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low	0.28	5	3	<2
Pulexas	37-80	8-18	1.30-1.50	2.0-6.0	0.11-0.15	6.1-8.4	<2	Low	0.28			

See footnote at end of table.

Table 14.—Physical and Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
RwB	0-16	20-27	1.35-1.50	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate	0.32	2	6	1-3
Rowden	16-38	35-60	1.35-1.50	0.06-0.2	0.12-0.17	7.4-8.4	<2	High	0.32			
	38-58	---	---	0.2-2.0	---	---	---					
SdB	0-14	3-15	1.25-1.43	2.0-6.0	0.05-0.09	5.6-7.3	<2	Low	0.17	5	2	<1
Selden	14-80	18-35	1.35-1.65	0.2-0.6	0.12-0.17	5.1-6.5	<2	Low	0.24			
SeC	0-14	40-55	1.40-1.50	0.06-0.2	0.12-0.18	7.4-8.4	0-2	Moderate	0.32	3	4	1-3
Set	14-48	35-55	1.40-1.60	0.06-0.2	0.12-0.18	7.9-8.4	0-2	Moderate	0.32			
	48-80	27-55	1.40-1.65	<0.06	0.12-0.18	7.9-8.4	0-2	Moderate	0.32			
SeE*:												
Set	0-12	40-55	1.40-1.50	0.06-0.2	0.12-0.18	7.4-8.4	0-2	Moderate	0.10	3	8	1-3
	12-42	35-55	1.40-1.60	0.06-0.2	0.12-0.18	7.9-8.4	0-2	Moderate	0.32			
	42-80	27-55	1.40-1.65	<0.06	0.12-0.18	7.9-8.4	0-2	Moderate	0.32			
Palopinto	0-6	18-35	1.25-1.45	0.6-2.0	0.10-0.15	6.1-8.4	0-2	Moderate	0.05	1	8	1-4
	6-14	18-35	1.25-1.45	0.6-2.0	0.10-0.15	6.1-8.4	0-2	Moderate	0.05			
	14-40	---	---	0.06-2.0	---	---	---					
ShF	0-7	6-18	1.45-1.60	2.0-6.0	0.08-0.13	6.1-7.3	0-0	Low	0.20	3	8	.5-1
Shatruce	7-32	35-50	1.40-1.55	0.06-0.2	0.14-0.18	5.1-6.5	0-0	Moderate	0.32			
	32-80	35-50	1.50-1.70	<0.06	0.06-0.10	5.1-6.5	0-0	Moderate	0.32			
ShG	0-6	6-18	1.45-1.60	2.0-6.0	0.08-0.13	6.1-7.3	0-0	Low	0.20	3	8	.5-1
Shatruce	6-25	35-50	1.40-1.55	0.06-0.2	0.14-0.18	5.1-6.5	0-0	Moderate	0.32			
	25-80	35-50	1.50-1.70	0.00-0.06	0.06-0.10	5.1-6.5	0-0	Moderate	0.32			
StC	0-8	10-20	1.40-1.65	2.0-6.0	0.13-0.19	5.6-6.5	0-0	Low	0.24	3-2	3	.5-1
Stephenville	8-25	18-35	1.35-1.75	0.6-2.0	0.13-0.19	5.6-6.5	0-0	Low	0.32			
	25-45	---	1.85-2.00	0.2-0.6	---	---	---					
ThA	0-6	27-35	1.40-1.65	0.2-0.6	0.11-0.14	6.1-7.8	0-2	Moderate	0.43	5	7	1-2
Thurber	6-50	35-55	1.40-1.65	0.00-0.06	0.09-0.13	6.6-8.4	0-2	High	0.32			
	50-80	25-45	1.40-1.70	0.00-0.06	0.09-0.13	7.4-8.4	0-2	High	0.32			
TrA	0-11	35-40	1.40-1.60	0.06-0.2	0.15-0.20	7.9-9.0	2-8	High	0.43	5	4L	0-.5
Treadway	11-34	40-60	1.35-1.60	0.00-0.06	0.08-0.12	7.9-9.0	2-8	High	0.37			
	34-60	40-60	1.35-1.60	0.00-0.06	0.05-0.07	7.9-9.0	4-16	High	0.37			
TuC	0-6	8-20	1.45-1.62	0.6-2.0	0.07-0.12	6.1-7.3	<2	Low	0.37	3	3	1-3
Truce	6-43	35-55	1.50-1.65	0.06-0.2	0.09-0.12	6.6-8.4	<2	Moderate	0.32			
	43-65	35-55	1.60-1.80	<0.06	0.05-0.09	7.4-8.4	<2	Moderate	0.28			

See footnote at end of table.

Table 14.—Physical and Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
VrC	0-6	40-60	1.35-1.55	<0.06	0.10-0.17	7.9-8.4	0-2	High	0.32	3-2	4	.5-2
Vernon	6-34	40-60	1.50-1.65	<0.06	0.10-0.15	7.9-8.4	0-2	High	0.37			
	34-60	40-60	1.70-2.00	<0.06	0.01-0.06	7.9-8.4	2-8	High	0.32			
W*.												
Water												
Wf	0-21	40-60	1.20-1.35	<0.06	0.12-0.18	6.1-7.8	<2	High	0.28	5	4	1-4
Westfork	21-40	35-60	1.25-1.35	<0.06	0.12-0.18	6.1-8.4	<2	High	0.32			
	40-80	35-60	1.30-1.40	<0.06	0.12-0.18	6.6-8.4	<2	High	0.32			
WhC	0-5	5-18	1.45-1.60	0.6-2.0	0.12-0.16	6.1-7.3	<2	Low	0.49	5	3	<1
Windthorst	5-44	35-50	1.45-1.65	0.2-0.6	0.12-0.17	5.6-7.3	<2	Moderate	0.37			
	44-64	15-45	1.50-1.68	0.2-0.6	0.12-0.16	5.6-8.4	<2	Moderate	0.37			
	64-80	15-45	1.50-1.70	0.2-0.6	0.11-0.16	6.1-8.4	<2	Moderate	0.49			
WnB	0-8	15-25	1.35-1.50	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low	0.28	5	5	<1
Winters	8-64	35-45	1.45-1.60	0.2-0.6	0.14-0.18	6.1-8.4	<2	Moderate	0.28			
	64-80	25-45	1.50-1.65	0.6-2.0	0.14-0.18	6.1-8.4	<2	Moderate	0.24			
WsC	0-8	18-30	1.30-1.50	0.6-2.0	0.12-0.15	7.4-8.4	0-0	Moderate	0.37	3	6	.5-2
Wise	8-26	20-30	1.35-1.60	0.6-2.0	0.09-0.12	7.4-8.4	0-0	Moderate	0.37			
	26-60	10-30	1.35-1.65	0.6-6.0	0.08-0.12	7.4-8.4	0-0	Moderate	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 15.—Soil and Water Features

("Flooding" and "water table" and terms such as "occasional," "brief," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
AdB—Aledo	C	None	---	---	>6.0	---	---	8-20	Hard	Moderate	Low.
AnB—Anocon	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
BaC—Bastsil	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
BgB—Bluegrove	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
BnB—Bonti	C	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate.
Bo—Bosque	B	Occasional	Brief	Oct-May	>6.0	---	---	>60	---	High	Low.
ChC—Chaney	C	None	---	---	>6.0	---	---	>60	---	High	Moderate.
CoD—Cona	C	None	---	---	>6.0	---	---	>60	---	High	Moderate.
DAM*. Dams											
DfC—Duffau	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
DgC*:											
Duffau	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
Gullied land	D	None	---	---	>6.0	---	---	>60	---	Low	High.
EdD*:											
Exray	D	None	---	---	>6.0	---	---	10-20	Hard	High	Moderate.
EdD*:											
Darnell	C	None	---	---	>6.0	---	---	10-20	Soft	Low	Moderate.

See footnote at end of table.

Table 15.—Soil and Water Features—Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Go---------- Gowen	B	Occasional	Brief-----	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
Gw---------- Gowen	B	Frequent----	Brief-----	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
HaA---------- Hassee	D	None--------	---	---	0.5-1.0	Perched	May-Oct	>60	---	High-----	Low.
HeB, HnB---------- Hensley	D	None--------	---	---	>6.0	---	---	10-20	Hard	High-----	Low.
JaB---------- Jacksboro	D	None--------	---	---	>6.0	---	---	15-20	Hard	High-----	Low.
KaB---------- Kamay	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
KtC, KtC2--------- Keeter	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
LDF*. Landfill											
LeA, LeB---------- Leeray	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
MwB---------- Minwells	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
OwE---------- Owens	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
PaB---------- Palopinto	D	None--------	---	---	>6.0	---	---	6-20	Hard	High-----	Low.
Pt*---------- Pits	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Pu---------- Pulexas	B	Occasional	Brief-----	Oct-May	>6.0	---	---	>60	---	Low------	Low.
Px---------- Pulexas	B	Frequent----	Brief-----	Oct-May	>6.0	---	---	>60	---	Low------	Low.

See footnote at end of table.

Table 15.—Soil and Water Features—Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
RwB—Rowden	C	None	---	---	>6.0	---	---	20-40	Hard	High	Low.
SdB—Selden	C	None	---	---	>6.0	---	---	>60	---	High	Moderate.
SeC—Set	C	None	---	---	>6.0	---	---	>60	---	High	Low.
SeE*:											
Set	C	None	---	---	>6.0	---	---	>60	---	High	Low.
Palopinto	D	None	---	---	>6.0	---	---	6-20	Hard	High	Low.
ShF, ShG—Shatruce	C	None	---	---	>6.0	---	---	>60	---	High	Moderate.
StC—Stephenville	B	None	---	---	>8.0	---	---	20-40	Soft	Moderate	Moderate.
ThA—Thurber	D	None	---	---	>6.0	---	---	>60	---	High	Low.
TrA—Treadway	D	None	---	---	>8.0	---	---	>80	---	High	High.
TuC—Truce	C	None	---	---	>6.0	---	---	>60	---	High	Low.
VrC—Vernon	D	None	---	---	>6.0	---	---	>60	---	High	Low.
W*. Water											
Wf—Westfork	D	Frequent	Brief	Apr-Nov	>6.0	---	---	>60	---	High	Low.
WhC—Windthorst	C	None	---	---	>6.0	---	---	>60	---	High	Low.
WnB—Winters	C	None	---	---	>6.0	---	---	>60	---	High	Low.

See footnote at end of table.

Table 15.—Soil and Water Features—Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
WsC—Wise	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 16.—Classification of the Soils

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Calciustolls
Anocon	Fine, mixed, thermic Udic Argiustolls
Bastsil	Fine-loamy, siliceous, thermic Udic Paleustalfs
Bluegrove	Fine, mixed, thermic Typic Haplustalfs
Bonti	Fine, mixed, thermic Ultic Paleustalfs
Bosque	Fine-loamy, mixed, thermic Cumulic Haplustolls
Chaney	Fine, mixed, thermic Aquic Paleustalfs
Cona	Fine, mixed, thermic Udic Paleustalfs
Darnell	Loamy, siliceous, thermic, shallow Udic Haplustepts
Duffau	Fine-loamy, siliceous, thermic Udic Paleustalfs
Exray	Clayey, mixed, thermic Lithic Rhodustalfs
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Hassee	Fine, smectitic, thermic Aquic Paleustalfs
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Jacksboro	Clayey-skeletal, mixed, thermic Lithic Haplustalfs
Kamay	Fine, smectitic, thermic Typic Paleustalfs
Keeter	Fine-silty, siliceous, thermic Udic Haplustalfs
Leeray	Fine, smectitic, thermic Typic Haplusterts
Minwells	Fine, mixed, thermic Udic Paleustalfs
Owens	Fine, mixed, thermic Typic Haplustepts
Palopinto	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Pulexas	Coarse-loamy, siliceous, nonacid, thermic Typic Ustifluvents
Rowden	Fine, mixed, thermic Typic Argiustolls
Selden	Fine-loamy, siliceous, thermic Aquic Paleustalfs
Set	Fine-silty, carbonatic, thermic Typic Calciustolls
Shatruce	Fine, mixed, thermic Typic Paleustalfs
Stephenville	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Thurber	Fine, smectitic, thermic Typic Haplustalfs
Treadway	Fine, mixed, thermic Torrertic Haplustepts
Truce	Fine, mixed, thermic Udic Paleustalfs
Vernon	Fine, mixed, thermic Typic Haplustepts
Westfork	Fine, mixed, thermic Cumulic Haplustolls
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Winters	Fine, mixed, thermic Typic Paleustalfs
Wise	Fine-silty, siliceous, thermic Udic Haplustepts

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98° 22' 30"

98° 00' 00"

CLAY COUNTY

ARCHER COUNTY

MONTAGUE COUNTY

33° 22' 30"

33° 07' 30"

N

YOUNG COUNTY

WISE COUNTY

Antelope

Postoak

Truce

Maryetta

Jermyn

Jacksboro

Senate

Bryson

Joplin

Perrin

West Fork Trinity River

Crooked Creek

Big Creek

Howard Creek

Cleveland Creek

North Creek

Big Sandy Creek

Lake Bridgeport

Jasper Creek

Brushy Creek

Rock Creek

Salt Creek

West Salt Creek

East Fork Keechi Creek

114

148

N281

380

199

PALO PINTO COUNTY

PARKER COUNTY

SOIL LEGEND*

1	Exray-Truce-Bonti
2	Shatruce
3	Hensley-Palopinto
4	Anocon-Thurber
5	Duffau-Windthorst-Keeter
6	Bluegrove-Kamay
7	Gowen-Westfork
8	Leeray

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1999

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

JACK COUNTY, TEXAS

Scale 1:126720

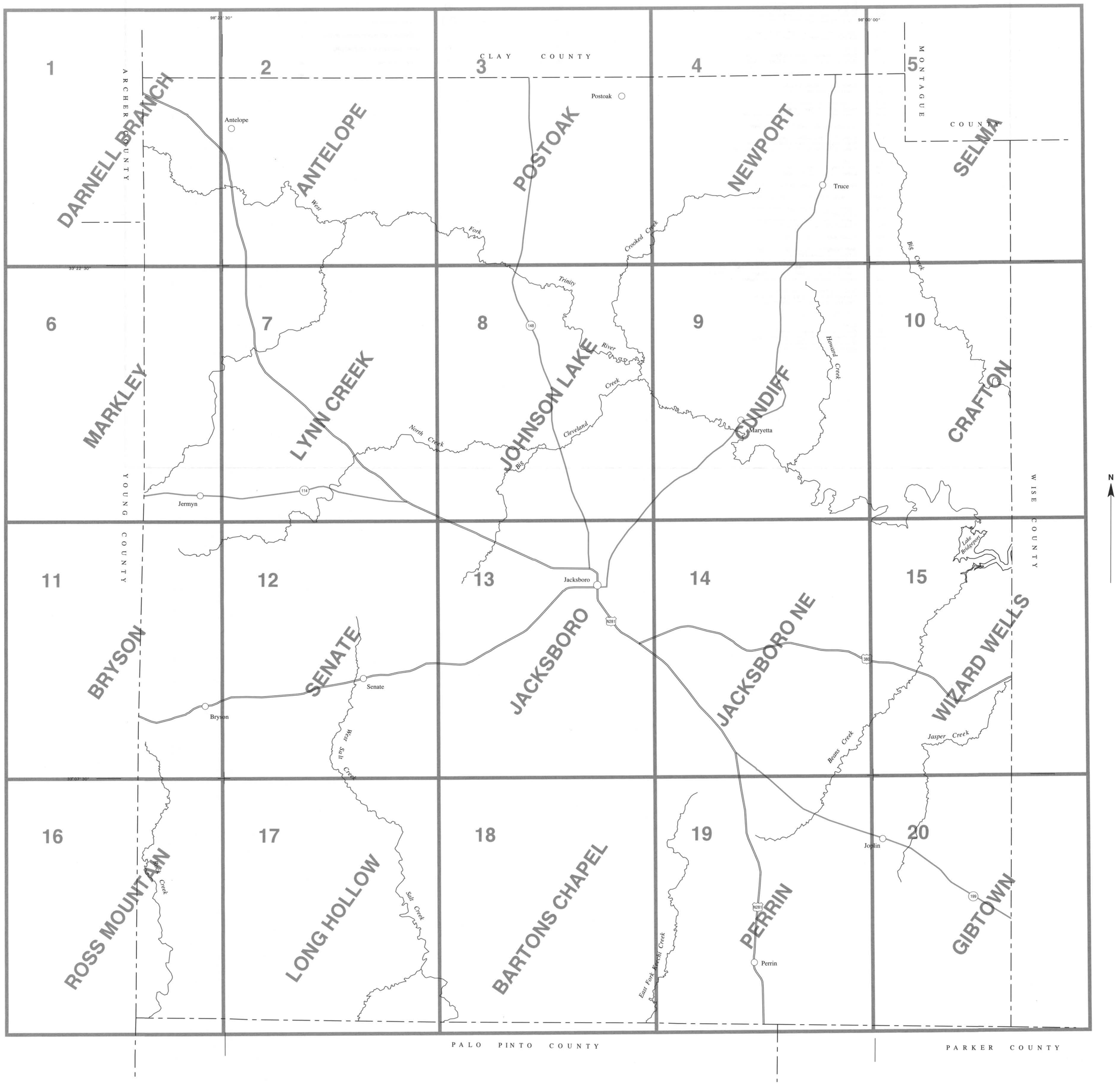
1 0 1 2 3

MILES

1 0 1 2 3 4 5 6

KILOMETERS

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
JACK COUNTY, TEXAS

Scale 1:126720

1 0 1 2 3
MILES

1 0 1 2 3 4 5 6
KILOMETERS

SOIL LEGEND

Map symbols consist of a combination of letters and numbers. The first capital letter is the initial one of the soil name. The second letter is a lowercase letter. The third letter is a capital letter that indicates slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. Symbols that are all capital letters represent miscellaneous areas. A final number of 2 following the slope letter indicates the soil is eroded.

SYMBOL	NAME
AdB	Aledo clay loam, 1 to 3 percent slopes
AnB	Anocon loam, 1 to 3 percent slopes
BaC	Bastsil fine sandy loam, 1 to 5 percent slopes
BgB	Bluegrove loam, 1 to 3 percent slopes
BnB	Bonti fine sandy loam, 1 to 3 percent slopes
Bo	Bosque clay loam, occasionally flooded
ChC	Chaney loamy fine sand, 1 to 5 percent slopes
CoD	Cona fine sandy loam, 3 to 8 percent slopes, stony
DAM	Dams
DfC	Duffau very fine sandy loam, 1 to 5 percent slopes
DgC	Duffau-Gullied land complex, 1 to 5 percent slopes
EdD	Exray-Darnell complex, 1 to 8 percent slopes, very stony
Go	Gowen loam, occasionally flooded
Gw	Gowen loam, frequently flooded
HaA	Hassee loam, 0 to 1 percent slopes
HeB	Hensley loam, 1 to 3 percent slopes
HnB	Hensley loam, 1 to 3 percent slopes, extremely stony
JaB	Jacksboro fine sandy loam, 1 to 3 percent slopes
KaB	Kamay loam, 1 to 3 percent slopes
KtC	Keeter very fine sandy loam, 1 to 6 percent slopes
KtC2	Keeter very fine sandy loam, 2 to 6 percent slopes, eroded
LDF	Landfill
LeA	Leeray clay, 0 to 1 percent slopes
LeB	Leeray clay, 1 to 3 percent slopes
MwB	Minwells fine sandy loam, 1 to 3 percent slopes
OwE	Owens clay, 5 to 25 percent slopes, very stony
PaB	Palopinto loam, 1 to 4 percent slopes, extremely stony
Pt	Pits, limestone
Pu	Pulexas fine sandy loam, occasionally flooded
Px	Pulexas fine sandy loam, frequently flooded
RwB	Rowden loam, 0 to 2 percent slopes
SdB	Selden loamy fine sand, 1 to 3 percent slopes
SeC	Set clay, 3 to 5 percent slopes
SeE	Set-Palopinto complex, 8 to 30 percent slopes, very stony
ShF	Shatruce gravelly fine sandy loam, 8 to 30 percent slopes, very stony
ShG	Shatruce gravelly fine sandy loam, 12 to 50 percent slopes, extremely bouldery
StC	Stephenville fine sandy loam, 1 to 5 percent slopes
ThA	Thurber clay loam, 0 to 2 percent slopes
TrA	Treadway silty clay loam, 0 to 2 percent slopes
TuC	Truce fine sandy loam, 1 to 5 percent slopes
VrC	Vernon clay, 3 to 8 percent slopes
W	Water
Wf	Westfork silty clay, frequently flooded
WhC	Windthorst fine sandy loam, 1 to 5 percent slopes
WnB	Winters loam, 1 to 3 percent slopes
WsC	Wise loam, 3 to 5 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Minor civil division

ROAD EMBLEM & DESIGNATIONS

- Federal (287)
- State (52)
- County, farm or ranch (1283)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Cemetery
- Windmill

WATER FEATURES

DRAINAGE

- Perennial stream
- Intermittent stream
- Drainage end (indicates direction of flow)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — LeA RwB

MISCELLANEOUS

- Rock outcrop

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
DARNELL BRANCH QUADRANGLE
SHEET NUMBER 1 OF 20

98°30′00″ 98°27′30″ 98°25′00″ 98°22′30″
33°30′00″ 33°27′30″ 33°25′00″ 33°22′30″
547 000m E 548 549 550 551 552 553 554 555 556 557 000m E 558
3706 3705 3704 3703 000m N 3702 3701 3700 3699 3698 3697 3696 3695 3694 3693 000m N

CLAY COUNTY
ARCHER COUNTY
YOUNG COUNTY

Gap Mountain
West Fork Brushy Creek
Salor Creek
Plum Creek
Trinity River

Joins sheet 2, Antelope
Joins sheet 6, Markley
Joins sheet 7, Lynn Creek

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, formerly Soil Conservation Service. Base maps are orthophotographs prepared by the Natural Resources Conservation Service, from 1995 aerial photography. Hydrography and cultural layers were acquired from the Natural Resources Conservation Service. The hydrography and cultural layers were edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

DARNELL BRANCH, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 1 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
ANTELOPE QUADRANGLE
SHEET NUMBER 2 OF 20

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETERS

QUADRANGLE LOCATION

ANTELOPE, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 2 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
POSTOAK QUADRANGLE
SHEET NUMBER 3 OF 20

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

POSTOAK, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 3 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
NEWPORT QUADRANGLE
SHEET NUMBER 4 OF 20

98°07'30" 98°05'00" 98°02'30" 98°00'00"
33°30'00" 33°27'30" 33°25'00" 33°22'30"
5682 000m E 5683 5684 5685 5686 5687 5688 5689 5690 5691 5692 000m E
3706 3705 3704 000m N 3703 3702 3701 3700 3699 3698 3697 3696 3695 3694 000m N

CLAY COUNTY

Newport

Gallilher Mountain

Truce

Newport Cemetery

Fork North Creek

East Fork Crooked Creek

Joins sheet 3, Postoak

Joins sheet 5, Selma

Joins sheet 8, Johnson Lake

Joins sheet 9, Cundiff

Joins sheet 10, Crafton

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

NEWPORT, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 4 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
SELMA QUADRANGLE
SHEET NUMBER 5 OF 20

98° 00′ 00″ — 97° 57′ 30″ — 97° 55′ 00″ — 97° 52′ 30″
33° 30′ 00″ — 33° 27′ 30″ — 33° 25′ 00″ — 33° 22′ 30″
3704 000m N

CLAY COUNTY
MONTAGUE COUNTY
WISE COUNTY

Big Creek
Cottonwood Creek

Joins sheet 4, Newport
Joins sheet 10, Crafton
Joins sheet 9, Cundiff

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

SELMA, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 5 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
MARKLEY QUADRANGLE
SHEET NUMBER 6 OF 20

Joins sheet 1, Darnell Branch

Joins sheet 2, Antelope

Joins sheet 7, Lynn Creek

Joins sheet 11, Bryson

Joins sheet 12, Senate

98°30'00" 98°27'30" 98°25'00" 98°22'30"

33°22'30" 33°20'00" 33°17'30" 33°15'00"

5547 000m E 548 549 550 551 552 553 554 555 556 557 000m E 558

3692 3691 3690 3689 000m N 3688 3687 3686 3685 3684 3683 3682 3681 3680 3679 000m N

YOUNG COUNTY

Plum Creek

Cameron Creek

Stewart Creek

Jermyn

Graceland Cemetery

Spie Knob

2950

114

1191

OLD RAILROAD GRADE

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

MARKLEY, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 6 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
LYNN CREEK QUADRANGLE
SHEET NUMBER 7 OF 20

Joins sheet 1, Darnell Branch

Joins sheet 2, Antelope

Joins sheet 3, Postoak

Joins sheet 6, Markley

Joins sheet 8, Johnson Lake

Joins sheet 11, Bryson

Joins sheet 12, Senate

Joins sheet 13, Jacksboro

98°22′30″ 98°20′00″ 98°17′30″ 98°15′00″

33°22′30″ 33°20′00″ 33°17′30″ 33°15′00″

Squaw Mountain

Indian Hills

Round Mountain

Roberts Branch Cemetery

Round Mountain Cemetery

Cameron Creek

Roper Branch

McBee Branch

Lynn Creek

Prairie Branch

Roberts Branch

North Creek

Henderson Creek

OLD RAILROAD GRADE

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

LYNN CREEK, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 7 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
JOHNSON LAKE QUADRANGLE
SHEET NUMBER 8 OF 20

Joins sheet 2, Antelope
Joins sheet 3, Postoak
Joins sheet 4, Newport
Joins sheet 7, Lynn Creek
Joins sheet 9, Cundiff
Joins sheet 12, Senate
Joins sheet 13, Jacksboro
Joins sheet 14, Jacksboro NE

98°15′00″ 98°12′30″ 98°10′00″ 98°07′30″
33°22′30″ 33°20′00″ 33°17′30″ 33°15′00″
570000m E 580000m E
3693 3692 3691 3690000m N 3689 3688 3687 3686 3685 3684 3683 3682 3681 3680000m N

West Fork Trinity River
Jones Creek
Crooked Creek
Sprules Creek
Dye Creek
North Fork Trinity River
Cleveland Creek
Big Cleveland Creek
Little Cleveland Creek
Pursley Branch
Johnson Lake
Brown Cemetery
Graves Cemetery
Patton Cemetery
DAM

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETERS

QUADRANGLE LOCATION

JOHNSON LAKE, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 8 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
CUNDIFF QUADRANGLE
SHEET NUMBER 9 OF 20

Joins sheet 3, Bostcak

Joins sheet 4, Newport

Joins sheet 5, Selma

Joins sheet 8, Johnson Lake

Joins sheet 10, Crafton

Joins sheet 13, Jacksboro

Joins sheet 14, Jacksboro NE

Joins sheet 15, Wizard Wells

98°07'30" 98°05'00" 98°02'30" 98°00'00"

33°22'30" 33°20'00" 33°17'30" 33°15'00"

3693 3692 3691 3690000mN 3689 3688 3687 3686 3685 3684 3683 3682 3681 3680000mN

582 000m E 583 584 585 586 587 588 589 590 591 592 000m E 593

Burton Springs Cemetery

Howard Valley Cemetery

Maryetta

Cundiff

Lost Creek Cemetery

Hall Creek

West Fork Trinity River

Howard Creek

Briar Branch

Trinity River

Bridgeport Lake

Carroll Cr

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NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

CUNDIFF, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 9 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
CRAFTON QUADRANGLE
SHEET NUMBER 10 OF 20

Joins sheet 5, Selma

98°00′00″ 97°57′30″ 97°55′00″ 97°52′30″
33°22′30″ 33°20′00″ 33°17′30″ 33°15′00″
3693 3692 3691 3690000mN 3689 3688 3687 3686 3685 3684 3683 3682 3681 3680000mN
594000mE 595 596 597 598 599 600 601 602 603 604000mE

Joins sheet 9, Cundiff

Joins sheet 14, Jacksboro NE

Joins sheet 15, Wizard Wells

Cundiff
Bear Knob
Cottonwood Creek
Flint Creek
Trinity River
WEST FORK TRINITY RIVER
LAKE BRIDGEPORT
Pecan Branch
WISE COUNTY
JACK COUNTY
24
1810

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NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

CRAFTON, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 10 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
BRYSON QUADRANGLE
SHEET NUMBER 11 OF 20

Joins sheet 6, Markley

Joins sheet 7, Lynn Creek

Joins sheet 12, Senate

Joins sheet 16, Ross Mountain

Joins sheet 17, Long Hollow

98°30′00″ 98°27′30″ 98°25′00″ 98°22′30″
33°15′00″ 33°12′30″ 33°10′00″ 33°07′30″
547 000mE 548 549 550 551 552 553 554 555 556 557 000mE 558
3678 3677 3676 000mN 3675 3674 3673 3672 3671 3670 3669 3668 3667 3666 000mN

YOUNG COUNTY

Bryson

McCloud Lake

Rock Creek Cemetery

Rock Creek

North Fork Lynn Creek

Dominion Creek

Trace Creek

Board Creek

OLD RAILROAD GRADE

1191 380

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

BRYSON, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 11 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
SENATE QUADRANGLE
SHEET NUMBER 12 OF 20

Joins sheet 6, Markley

Joins sheet 8, Johnson Lake

Joins sheet 7, Lynn Creek

Joins sheet 11, Bryson

Joins sheet 13, Jacksboro

Joins sheet 16, Ross Mountain

Joins sheet 17, Long Hollow

Joins sheet 15, Bartons Chapel

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

MILES

FEET

KILOMETERS

QUADRANGLE LOCATION

SENATE, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 12 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
JACKSBORO QUADRANGLE
SHEET NUMBER 13 OF 20

Joins sheet 7, Von Creek

Joins sheet 8, Johnson Lake

Joins sheet 9, Cundiff

Joins sheet 12, Senate

Joins sheet 14, Jacksboro NE

Joins sheet 17, Long Hollow

Joins sheet 18, Bartons Chapel

Joins sheet 19, Perrin

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1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

JACKSBORO, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 13 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
JACKSBORO NE QUADRANGLE
SHEET NUMBER 14 OF 20

Joins sheet 8, Johnson Lake

Joins sheet 9, Cundiff

Joins sheet 10, Crafton

Joins sheet 13, Jacksboro

Joins sheet 15, Wizard Wells

Joins sheet 18, Bartons Chapel

Joins sheet 19, Perrin

Joins sheet 20, Gliotown

98°07′30″ 98°05′00″ 98°02′30″ 98°00′00″
33°15′00″ 33°12′30″ 33°10′00″ 33°07′30″
5682 000m E 5683 5684 5685 5686 5687 5688 5689 5690 5691 5692 000m E 5693
3679 3678 3677 3676 000m N 3675 3674 3673 3672 3671 3670 3669 3668 3667 3666 000m N

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1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

JACKSBORO NE, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 14 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
WIZARD WELLS QUADRANGLE
SHEET NUMBER 15 OF 20

Joins sheet 10, Crafton

Joins sheet 14, Jacksboro NE

Joins sheet 19, Perrin

Joins sheet 20, Gibtown

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

WIZARD WELLS, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 15 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
ROSS MOUNTAIN QUADRANGLE
SHEET NUMBER 16 OF 20

Joins sheet 11, Bryson

Joins sheet 12, Senate

Joins sheet 17, Long Hollow

98°30′00″ 98°27′30″ 98°25′00″ 98°22′30″
33°07′30″ 33°05′00″ 33°02′30″ 33°00′00″
547 000m E 548 549 550 551 552 553 554 555 556 557 000m E 558
3662 000m N 3663 3664 3665 3661 3660 3659 3658 3657 3656 3655 3654 3653 3652 000m N

YOUNG COUNTY

PALO PINTO COUNTY

Creek
Tree Creek
Board Creek
McCrumbar Branch
Big Back Branch
Coon Branch
Hop Hill
Timber Ross Valley Creek
Ross Mountain
Pitts Mountain
Bear Mountain
Creek
Dillingham Creek
Pinnington Creek
Spring Creek
1191

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

ROSS MOUNTAIN, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 16 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
LONG HOLLOW QUADRANGLE
SHEET NUMBER 17 OF 20

Joins sheet 11, Bryson

Joins sheet 12, Senate

Joins sheet 13, Jacksboro

Joins sheet 16, Ross Mountain

Joins sheet 18, Bartons Chapel

98°22′30″ 98°20′00″ 98°17′30″ 98°15′00″

33°07′30″ 33°05′00″ 33°02′30″ 33°00′00″

59,000mE 60 61 62 63 64 65 66 67 68 69,000mE 70

3665 3664 3663 3662,000mN 3661 3660 3659 3658 3657 3656 3655 3654 3653 3652,000mN

Saint Creek Cemetery
Long Hollow Cemetery
Wood Cemetery
Halsell Ranch Cemetery
Deck Mountain
Dillingham Spring
Saint Creek
West Fork
East Fork
Long Hollow Creek
Spring Creek
Spring Branch
PALO PINTO COUNTY

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NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

LONG HOLLOW, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 17 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
BARTONS CHAPEL QUADRANGLE
SHEET NUMBER 18 OF 20

Joins sheet 12, Senate

Joins sheet 13, Jacksboro

Joins sheet 14, Jacksboro NE

Joins sheet 17, Long Hollow

Joins sheet 19, Perrin

98°15′00″ 98°12′30″ 98°10′00″ 98°07′30″
33°07′30″ 33°05′00″ 33°02′30″ 33°00′00″

Springdale Cemetery

Bartons Chapel Cemetery

Tetteriller Hill

Bartons Chapel

Keechi Creek

West Fork

Bunch Creek

Springdale

Salt Creek

Rock Creek

PALO PINTO COUNTY

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

MILES

FEET

KILOMETERS

QUADRANGLE LOCATION

BARTONS CHAPEL, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 18 OF 20

Joins sheet 13, Jacksboro

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Joins sheet 14, Jacksboro NE

JACK COUNTY, TEXAS
PERRIN QUADRANGLE
SHEET NUMBER 19 OF 20

Joins sheet 15, Wizard Wells

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1000 meter tics: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

SCALE 1:24000

MILES

FEET

KILOMETERS

QUADRANGLE LOCATION

PERRIN, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 19 OF 20

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

JACK COUNTY, TEXAS
GIBTOWN QUADRANGLE
SHEET NUMBER 20 OF 20

Joins sheet 14, Jacksboro NE

Joins sheet 15, Wizard Wells

Joins sheet 19, Perrin

98°00′00″ 97°57′30″ 97°55′00″ 97°52′30″

33°07′30″ 33°05′00″ 33°02′30″ 33°00′00″

594 000m E 595 596 597 598 599 600 601 602 603 604 000m E

3665 3664 3663 3662 000m N 3661 3660 3659 3658 3657 3656 3655 3654 3653 3652 000m N

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NORTH

SCALE 1:24000

1 0 1
MILES

1000 0 1000 2000 3000 4000 5000 6000 7000
FEET

1 0 1
KILOMETERS

QUADRANGLE LOCATION

GIBTOWN, TEXAS
7.5 MINUTE SERIES
SHEET NUMBER 20 OF 20